INTER MODALITY TRANSFER AND ITS PERSONALITY CORRELATES

A

THESIS

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CERTIFICATE

This is to certify that the thesis entitled " [illegible] " submitted by Mrs. Anjali Jain has been done under my supervision and guidance and constitutes her own work.

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CHAPTER I

INTRODUCTION

CHAPTER I

INTRODUCTION

> Save through sensations we can know nothing either of the forms of matter, or of the forms of motion" (Lewin 1914).

The growth of natural sciences in general and biological sciences in particular have shown that various sense organs which give rise to the sensory experiences have great biological significance for the organism. Growing volumes of researches revealed that knowledge of the external world is contingent upon the organism's sense organs, brain and nervous structure; that there is a definite relationship between the sensory experience and the external environment; that this sensory experience is psychological and, that which was earlier thought by philosophers unmeasurable can be measured and quantified. This body of knowledge dispelled the age old notions of philosophers about the relationship between 'mind' and 'matter', and, drew the attention of researchers from various disciplines each as philosophy, physiology, anatomy etc. As a result, vigorous attempts were made during the latter half of the nineteenth century to unravel the laws of sensory processes and their place in psychological functioning. Early researches which explored the physiological basis of elementary psychological processes were initiated by Helmholtz,

Weber, Fechner, Muller etc. (See Boring 1957). Since then researches in the area of sense physiology and related psychological phenomenon have been pouring in.

The publication of Darwin's 'Origin of Species'(1859) was another event which changed the outlook of researchers about human beings. It was Darwin's theory of evolution which for the first time in human history showed continuity between animals and human beings and which had a profound effect on the psychophysiological study of human behaviour. It revealed that the complex structure of sense organs, nervous system and brain found in human beings are the result of evolution, and that orderliness in an individuals behaviour is the function of the degree of coordination among them. The high degree of coordination among the various sensory processes that are observed in human beings have been achieved after a long period of struggle to serve the biological survival and growth. This is what Smith (1927) means when he says : "Man has evolved as a result of the continuous exploitation throughout the Tertiary period of the vast possibilities which the reliance upon vision as the guiding sense created for a mammal that had not lost the plasticity of its hand by too early a specialisation. Under the guidance of vision the hands were able to acquire skill in action and incidentally to become the instruments of an increasingly sensitive tactile discrimination, which again

reacted upon the motor mechanisms and made possible the attainment of yet higher degrees of muscular skill, but, this in turn reacted upon the control of ocular movements and prepared the way for the acquisition of stereoscopic vision and a fuller understanding of the world and the nature of the things and activities in it.

All such developments led philosopher-psychologists and physiological-psychologists of the last century to look for new explanations of psychological phenomenon. Investigators begun their attack on various psychological processes such as sensation, perception, learning, motivation etc. On the assumption that their basis is physiological. Early researchers concentrated on various sensory processes such as visual, tactual and auditory and on their relative dominance. Wundt (1873) was the first psychologist to attempt to determine the relative dominance of various sense organs. It was he who has shown that some sense organs are more efficient and quicker than others in receiving information from the external world and transmitting the same to the cortex. For example, Wundt pointed out that "Slightly but still very noticeable is the retardation (in quickness of response) if one arranges the experiment to have the observer in ignorance as to whether light, sound or touch impressions (stimuli) will be forthcoming, so that the attention cannot be turned to a particular sense

organ. Immediately one notes a peculiar unrest because the stream of attention continuously vacillates among the several senses." This shows that various sense organs tend to compete with each other when activated simultaneously by various stimuli from the external world, and the resulting behaviour is the function of the superiority of the particular sense organ.

The entire body of knowledge on sensory processes and related phenomenon can be classified into three broad categories. These are:-

(a) Relative sensitivity of various parts of the body.
(b) Relative efficacy of different forms of stimulus material.
(c) Interaction among various sense modalities.

These categories reflect the shifting emphasis of researchers with the accumulation of knowledge and improvement in measurement. They also represent the historical sequence in which they have been undertaken, that is, initially researches on sensory processes were of an elementary nature. Sophistication and experimentation in this area of knowledge were gradually introduced.

(a) Relative Sensitivity of Various Parts of the Body: Investigations on the relative sensitivity of various parts of the body were based on the assumption that there is a variation in

the degree of sensitivity to the given stimulation. Weber was the first to test this assumption. His researches which were mainly confined to the sense of touch have shown that there is a definite relation between intensity of stimulation and the intensity of the sensory experience. Weber studied three classes of touch sensation viz., temperature, pressure and locality. He has shown that warmth and cold are simply positive and negative sensations of temperature and that its experience varies from one part of the body to another, i.e., to say, sensation has a spatial characteristic. Weber further attempted to measure the threshold for such sensations, which led him to conclude that variation in the sensation depends on the distribution of nerve fibres. He also demonstrated the existence of a "muscle sense" which led many to investigate muscular sensation. (Steinbuch 1811, Bichat 1812 and Thomas Brown 1820). Ref. No. 113

Thus Weber's investigations on touch sensations revealed that sensation is measurable and that it has a definite relation with stimulus intensity. Fechner, utilising this knowledge formulated a law of sensation known as Weber-Fechner law. This law had a great impact on the future investigations in the area of sensory processes. Fechner's formulations led to the emergence of psychophysics as an independent discipline.

(b) Relative Efficacy of Different Forms of Stimulus Material. This second approach to the study of sensory processes dealt with

the adequacy and efficacy of different forms of stimulus materials. All such studies were based on the assumption that certain stimulus figures are perceived more easily than certain others. Based on such an assumption Major (1893) tested two types of circles (solid and outline) and two types of triangles similarly constructed. He ranked the outline circles as easiest to discriminate and the solid circles as most difficult. The outline and solid triangles ranked intermediate in that order.

Similarly, Zigler and Barrett (1961) employed 5 types of stimuli-square, equilateral and right angles, diamonds and hexagons. Five sizes of each figure and three constructions (solid, outline and point) were used. The outline figures yielded the most accurate scores when tested on the thumb and the triangle ranked best of the figures tested.

In this second category of existing literature a study of discrimination through emphasis on the somatic cutaneous experience viz. pressure, pain, warmth and cold are also included.

(c) Interaction Among Various Sense Modalities This category of existing studies involves the investigation of sensory input through one modality affecting the functioning of another sense modality.

That there actually is interaction between the sensory

organs is confirmed by any number of everyday observations. A sound like the scraping of a knife on glass evokes a sensation of "creeps" in very many people. Light and sound specially high pitched aggravates toothache. Extremely high pitched sounds tend to cause nausea. Pain in one part of the body will often alleviate when pain is evoked in mother part of the body. For this reason, many people, bite their lips and clench their fists to make the severer pain bearable. Excessively hot food causes a sensation of high temperature which annuls the taste. Very heavy objects seem lighter when lifted during aural stimulation by music. Objects which darkness makes indiscernable to one eye only, become well visible when we open the other eye also. Musicians know that good lighting amplifies sound, and an orchestra is heard better if the concert hall lights are left on. These and very many such examples prove the interaction among the various sense organs.

The senses of vision and touch have been the subject matter of research for a long time. They have been experimented upon independently and also the intersections between them have been brought under various studies. To give only a few instances it may be cited that as early as 1926 Zigler and Northrup carried out investigations on the skin and vision. They conclude that "tactual form is not so definitely and unfailingly apprehended as tactual pressure.....Tactual pressure is invariably

perceived while tactual form is not clear .... all change at about the same region of the retina" (1926). In 1927 Zigler and Barrett and again Zigler, Cook and Miller (1927) concluded that forms do not appear in perception more than they do on the skin.

In recent years a sizable literature has been developing aimed at comparing the relative efficacy of the visual and haptic modalities in the recognition and discrimination of objects. Most studies have indicated that form discrimination and recognition is relatively superior in visual intramodal tasks and poorest in haptic intramodal tasks, with intermediate levels of performance obtained in cross modal paradigms. On the basis of limited evidence (Rock and Victor 1964, Legg 1965, Kress and Cross 1969) it would appear that tactual input do not significantly improve performance obtained on the basis of visual input al ne. On the other hand Ettlinger's study (1961) of object discrimination indicated that combined visual and tactual experience with objects which may lead to significantly improved performance when the objects are offered exclusively for tactile discrimination. An aspect of visual-tactual (bimodal performance) is the effect of delay on form discrimination. It often is assumed that the quality of performance is a decreasing function of the amount of delay between acquisition and testing, independent of the relevant modality.

That interaction does undoubtedly exist between the sensory organs, is confirmed by a number of observations given above, and proved by the studies outlined in the preceding

paragraph. The present study also undertakes to investigate this transfer facility. By research in sensory interaction is meant, generally, investigations that explore modifications of response in one sense organ under direct stimulation when another sense organ has been or is subject to its own characteristics stimulus. The two senses taken to investigate the transfer phenomenon were vision and touch. A certain knowledge is given through one sense organ (eye or skin) and retention or learning of this knowledge is measured through another sense organ (skin or eye) which earlier was not subjected to stimulation. Thus, an object is presented first to the visual sense, and later to the sense of touch for identification and with vision excluded. Correct identification would mean that knowledge has been transferred from one modality (visual) to another (tactual).

The next question that arises is the question of how the phenomenon of sensory interaction correlates with personality. The relationship between them, it may be assumed, is essentially a holistic one. The organism is regarded as an entity comprised of certain interdependent parts which characterize it as a whole. For the understanding of the whole system the relationship and integration of parts in isolation need to be studied. Thus, in contrast to the Gestalt theory which treats system for visual, tactual, motor etc. as encapsulated, the sensory theory focusses on interrelationships

and interactions between the senses. Wapner and Werner (1949) pointed out the paradox - "how is it possible that intrinsically different elements such as sensory and motor can affect one another ?" The paradox of this interaction can be resolved by assuming certain dynamic states to which sensory and motor factors contribute. The basic assumption could then be that "perception is a reflection of the relation between proximal stimulation and ingoing organismic states." Proximal stimulation is defined as stimulation of sensory surfaces which issues from a physical object and organismic state represents the total ongoing state of the organism as it is affected by present internal stimulation, dynamic state and stimulation from source other than those of the object attended. Thus behaviour is so to speak a reflection of a part of "proximal stimulation" in relation to the content of organismic activity or "organismic state". Given this formulation it follows that changes can occur as a function of changes in either aspect of the polarity of "organismic state" or the "proximal stimulation". This notion of duality has led to the present study where the state of "proximal stimulation" is manipulated by variation in extraneous stimulation such as visual and tactual, and the corresponding variation in the state of the organism is determined. A rather satisfactory explanation can be obtained through an analysis of individual differences also. Information is provided through a particular sense organ and the same measured through

the activity of another sense modality not stimulated earlier. Subsequent to the stimulation of a particular modality and prior to the response or test of another modality, is a stage where the incoming information is transformed and processed into a different channel - thereby proving transfer. This implies that the information is conveyed to the brain and then processed into a different channel. The central influences on sense organs are ever present in actual reality, in as much as sensations are inseparably bound with the process of thought and the body operates as an integral whole. The dynamic linkage between the sense of body and the sense of self suggests that the ready fusion of body and field in experience may in turn signify a self which is limited both as to segregation and inner structure. This "self" or "style" is encapsulated within the organism. An enquiry into different modes of orientation and different degrees of transfer is an indicator of the nature of personality attributes found to distinguish people.

CHAPTER II

INTERGENCY TRANSFER - A REVIEW

CHAPTER II

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By research in sensory interaction is meant generally investigations that explore modifications of response in one sense organ under direct stimulation when another sense organ has been or is subject to its own characteristic stimulus.

A survey of the historical background reveals that all past experiments may be broadly classified into 3 categories.

First, there have been experiments determining the relative sensitivity of various parts of the body. In general, it may be said that the arm is more sensitive than the thighs, the palm more sensitive than the forearm, fingertip more sensitive than the palm and the tongue the most sensitive of all. These investigations, though numerous in number, are however, not much relevant in the discussion on sensory interaction.

Secondly, there have been experiments dealing with the adequacy of various stimulus materials. There are findings which indicate that elementary forms such as square, circle and triangle are recognised more rapidly than more complicated forms. The latter necessitate reconstruction from knowledge of single parts. Major tested two types of circles (solid and outline) and two types of triangles similarly constructed. He ranked the outline circles as easiest to discriminate and the

solid circles as most difficult. The outline and solid ranked intermediate in that order. Zigler and Barrett (1926) employed 6 types of stimuli — square, equilateral and right angles, diamonds and hexagon . Five sizes of each figure and 3 constructions (solid, outline and point) were used. The outline figures yielded the most accurate scores when tested on thumb and the triangle ranked best of the figure tested. In another study Zigler and Northrup (1926) presented patterns of confusion found when several figures were tested. An analysis of such patterns would be critical before practical application of such figures would be possible. In this category of existing experimental literature a study of discrimination through emphasis on the somatic cutaneous experience viz., pressure, pain, warmth and cold is also included.

The third category of studies, and the one most important and relevant to the present study, involves the investigation of sensory input affecting the functioning of another modality.

Already in the 17th century the well known Danish anatomist Thomasius Bartolinus described observations according to which people with poor hearing heard better in the light than in darkness. In the late 19th century Ebermaier and Horn made special investigations in which they too found illumination

of the head to enhance hearing in people suffering from ear diseases.

A prominent part in research on sensory interaction belongs to Russian scientists who were largely pioneers in this field of psychophysiology. So, back in 1870 Vedensky observed a case of increased limbic tactile activity under the effect of lighting. Godnev's thesis presented in Kazan (1832) described experiments exhibiting changes in cutaneous, olfactory and auditory sensitivity under varying light conditions of illumination. In the same year 1832, the Russian 'Zhenedelnaya Clinicheskaya gazet' (clinical weekly) published Manassein's 'Notes on a Forgotten Case of Dr. Marcroge'. The case in question had to do with paralysis of the left arm and paresis of the left leg, which were cured after one or two months of tactile stimulation by tickling the afflicted palm and heel with a feather.

Ref. No. 113

In 1835 Istomanov investigated the effect of different kinds of stimulation of the sensory nerves, on peripheral and cerebral blood volume, blood pressure pulse frequency and skin temperature. The stimuli employed were tactile (touch, pain, cold and warmth) gustatory, auditory and optical. Some stimuli appeared to cause constriction of the peripheral vessels with concomitant cerebral vasodilation,

while others led to the reverse. Thus, weak tactile sensations, cold malodorous substances as well as bitter and sour tastes evoked a marked outflow of blood from the limbs with a simultaneous inflow of blood to the cerebral vessels.

Conversely, sweet tastes, pleasant smells, warmth and mild pain usually caused an increase of limbic volume and cerebral vasoconstriction. Auditory stimulation, according to Istamonov is accompanied by a reduction of skin temperature and limbic volume, accelerated pulse and increased blood pressure. Transition from darkness to light and vice versa reduced the ~~add~~ limbic volume, accelerated the pulse and increased blood pressure.

Shortly before Istamonov, changes in limbic blood supply and respiratory movements under the effect of different sounds were described by Vogil, Ref. No. 113 who also made use of plethysmography. Changes in the blood supply of a hand in one of Vogil's laboratory janitors a Tartar by nationality, were especially marked when a Tartar melody was played in his presence. This indicates that certain importance in such cases may be attributed to the emotional effect of music.

An observation testifying to the systematic influence of muscular motor sensations is recorded in one of the later works by I.M. Sechenov, Ref. No. 112 the Father of Russian Physiology, on

'Effects of Sensory Stimulation on Muscular Activity in Man.' Sechenov employed a special ergograph to investigate the working capacity of his arm and leg and the effects of rest. The results of the experiment were, at first glance, rather unexpected. As Sechenov, himself wrote, "most effective in restoring energy to my surprise, was not the temporary voluntary repose of the working hand but its even shorter relaxation associated with the work of the other hand." To make this more convincing, he further says, "we may recall the effect of music on soldiers tired by a long march or the bracing effect of singing at work."

Interaction among single organs was a special subject of research by V. Urbantschitsch in the eighties of the last century. This author staged numerous experiments to investigate the effects of aural sensations on colour perception, visual acuity and olfactory, gustatory and tactile sensitivity as well as changes in other sensations elicited by gustatory olfactory and tactile stimulation. He recorded numerous observations testifying that such interaction undoubtedly exists. When a vibrating tuning fork is held beside the ear, the colour of a small field observed by the eye often becomes more distinct. However, in some cases of aural stimulation, colour was noticed to disappear. The effect varied with the force and pitch of sounds and vibrations of colour. Sounds, particularly high

pitched, improved visual acuity. Under the effect of sounds, tastes and smells were perceived better in some cases and worse in others. Light stimulation usually intensified heard sounds. Alternate shading and lighting of visual fields usually caused notable variations in the intensity of aural sensations. Not infrequently, the pitch of heard sounds was observed to change under varying visual stimulation. Temperature sensations also had their effect on other, particularly colour sensations.

Urbantschitsch himself summarised his experiments as follows:

"The absolute physiological law to be derived from all cited observations is that the stimulation of one organ has an influence on other sensations. This influence depends on the sense organ being stimulated, and often proves to vary with the intensity of the primarily elicited sensation. On the other hand, we have observed, individual distinctions, whereas, occasionally, repeated experiments on one and the same subject produced different results. I would particularly like to stress that obdurate reactors often had to be trained for some time before they evinced more vivid reactions. Moreover, it should be noted that at different times the intensity of the response in the same individual may vary considerably."

In 1904 Academician P.P. Lozarev Ref. No. 11 demonstrated the amplification of sound by light at a meeting of the Physiological Department of the Moscow Association of Natural History,

Anthropology and Ethnography. Lozarev alternately illumined and darkened a screen set up before the audience. The spectators could clearly perceive that a sufficiently loud sounding tuning fork was better audible in light than in darkness. Rapid alternation of dark and light was accompanied by a vivid sensation of pulsating sound. These experiments were initially described by Lozarev in the magazine 'Le Physiologie Russe' Vol.4 and later in more detail, in the Isvestia Akademii Nauk for 1918.

A particular wealth of research on the subject was published in the Soviet Union during the last 25-30 years. Interest was created in the subject by certain experiments on "eye-less vision". Rosa Kuleshova's ability to "see" with her fingertips, to identify colour and to read print when blind folded attracted widespread attention in Soviet scientific circles. She was carefully tested by various scientific organisations using various methods. It was hypothesised that : the subject in reading and identifying colours with her fingertips, does what one would do if the eye's retina were located there, it was a case of extrasensory perception and of dermal-optic perception. The possibility of thought perception was ruled out by additional experiments on the subject. It was stated that a well pronounced dermal optic sense is a rare but not a new phenomenon and that examples of it are found in the literature. It was proposed that photosensitive substances similar to those

existing in the retina are also contained in the skin. Tactile "sight" is an electromagnetic or an electric phenomenon Rosa's faculty may be accounted for by the fact that the dermal optic sense allows the subject to identify colour and print by in direction, to translate the language of tactile sensations into that of visual sensations.

All the above studies point to how sensory input in a particular modality affects the functioning of an other modality. There another group of studies which point out that input in one modality is transformed and used for discrimination task in a different modality.

Several investigations carried out on the skin and on vision reveal that form is not primary. Ziggler and Northrup (1926) report that inspite of the fact that their O's were instructed to look for forms when geometrical figures were applied to the volar surface of the left forearm, "all O's were unable to perceive any shape at all not even enough to warrant a guess." "A definite and complete form was the exception rather than the rule." The O's felt pressures as such before forms were felt. They conclude that "tactual form is not so definitely and unfailingly apprehended as tactual pressure..... Tactual pressure is invariably perceived, while tactual form is not clear....all change at about the same region of the retina. Form as such not only fails to appear,

but exerts no effect upon what is seen and where it is seen, otherwise there would be a difference for different forms. These authors tell us that "no type of figure manifests a consistent advantage over others in the matter of being perceptible further a field."

Again in 1927 Zigler and Barrett found that form does not disappear in tactual perception. When we come to vision we discover that forms do not appear in perception more than they do on the skin. Zigler, Cook and Miller (1927) also not find any differences among forms in the place where they change from formless to clear. These authors tell us that "no type of figure manifests a consistent advantage over others in the matter of being perceptible further afield."

In a study, by Anne Ewert and Carp (1965) on a group of blind and sighted children using 3 stimulus block reveals that visual imagery is not a critical factor in this kind of form recognition. Analysis indicated no significant effect of vision, IQ or CA on test scores. However, there was a significant interaction between vision and IQ.

In recent years, a body of literature has been developing aimed at comparing the relative efficacy of the visual and haptic (active touch) modalities in the recognition and discrimination of objects. Most studies have indicated that form discrimination and recognition is relatively superior in

visual intramodal tasks and poorest in haptic intramodal tasks, into intermediate levels of performance obtained in cross-modal paradigms. While visual and haptic performances have been been studied separately or in cross-modal transfer paradigms, little information is available regarding their interactional functioning. On the basis of limited evidence (Kress and Cross, 1966, Legge, 1965, Rock and Victor, 1964) it would appear that proprioceptive tactual (textural) and haptic input do not significantly improve performance obtained on the basis of visual input alone. In some cases information may even lead to poorer performance.

On the other hand Ettlingers (1961) study of object discrimination in monkeys indicated that combined visual and tactual (textural) experience with objects which may lead to significantly improved performance when the objects are later offered for exclusively tactile discrimination. In short empirical evidence above the role of bimodal versus unimodal sensory learning is still far from complete. A second aspect of visual haptic (bimodal performance) is the effect of delay on form discrimination. It often is assumed that the quality of performance is a decreasing function of the amount of delay between acquisition and testing, independent of the relevant modality. However, the results of one Russian study (Lavrentieva and Ruzskaya 1960) - 'Comparative Analysis of Touch and Vision' contradict this view.

Previous work on discrimination shows that the ability to differentiate between deficient forms is well developed in normal children by the age of 5, whether the stimuli are simple, geometric figures (Birch and Lefford 1967) random polygons (Brown and Goldstein 1967), or letters or alphabets (Gibson, Osser, Schiff and Smith, 1964). The discrimination of identical forms in different orientations is a less easy task. Ghent has demonstrated definite orientation preferences, affecting accuracy of recognition in a matching form sample situation, in children upto 3 years old. (Ghent 1960, Ghent and Bernstein 1961, Fraine 1966). Stimulus alignment has been shown to influence responses in a regular fashion in children (Sekuler and Rosenblith 1964) and in adults (Sekuler and Houlihan 1968).

The general observation that dual sensory input enhances signal detectability is of considerable interest from the information processing stand point. Previous experiments on the effects of intersensory interaction have been concerned primarily with an observer performance on a vigilance task. These studies have not produced results that are sufficiently precise to define the extent and manner of sensory interaction. The general problem of detecting redundant sensory stimuli in the threshold region has been investigated in various vigilance studies (Buckner and Macworth 1963, Loveless 1957, Osborne, Sheldon and Baker 1963). These investigations have been concerned primarily with the performance of untrained

observers on watch standing and human factors type test rather than form a basic information processing standpoint. A notable enhancement in performance occurs when the observers are given redundant information occur in the form of simultaneous auditory and visual displays. Several generalisations have been made regarding the interaction of the sensory systems but the precise function of continued sensory performance has not been determined. Buckner and MacGarth (1963) made note of the possible independent operation of the two sensory channels, but did not obtain good experimental verification of this assumption in their watch standing tests. The same model was considered by Loveless (1957) who found that on shorter tests the subjects on occasion were able to perform as expected. Broadbent (1964) proposed the application of signal detection to the problem, and it is agreed that some such statistical tool must be employed in order to assess accurately the function of dual sensory responses.

Although one expects judgments of size to vary to some extent from person to person, one might expect the successive judgments of an individual to be fairly consistent, giving constant viewing conditions, any variations amounting to no more than random error. We have, however, more than one modality by which we may judge size : the question is now whether there is an exact correspondence between any two of these within a single individual. In other words, do things look the same size

as they feel ? Berkeley (1909) saw clearly the difficulties in investigating such a problem. He wrote: "the visible object still changing as you approach or recede from the tangible object it hath no fixed or determinate greatness. Whenever, therefore, we speak of the magnitude of anything.... we must mean the tangible magnitude; otherwise there can be nothing free from ambiguity spoke of it. If this be true, it should be possible to make reliable cross-modal comparisons, a task which several experimenters have attempted."

In 1886, Jastrow investigated the perception of short lengths (5 to 120 mm) by disparate senses. Eye, hand and arm were presented with varying distances which were then reproduced by the same or one of the 2 sense organs. Jastrow found that the length of a felt object could be matched visually and vice-versa but that systematic illusions of size occurred. When the "receiving" and "expressing" sense are the same, the "error is small and process relatively easy." When, however, different senses act as received and expresser, results varied considerably. Regardless of which was the receiving sense, lengths expressed by the hand were overestimated and by the eye underestimated. When the arm was the mean of expression, lengths presented to the eye were overestimated, but lengths presented to the hand were underestimated. In every case the extent of the error decreased as the length to be judged increased. Jastrow concluded that it was the expressing

sense that determined the directions and extent of the error. Moreover, all the relations he established were reflexive, in that "if reproducing one sense by another results in an exaggeration (or underestimation), then reproducing the second sense by the first will result in an underestimation (or exaggeration) to about the same extent. Nevertheless, receiving and expressing by different senses was a task both "inaccurate and difficult". Jastrow felt therefore that "the connection between the senses seems to be a loose one", and concluded that the order of differential sensibility of the three senses was sight, span (hand) and motion (arm).

Unlike Jastrow, Kelvin (1954) found no significant difference between ipsimodal and cross modal judgments, using disc discs rather than varying chord lengths. However, Kelvin and Malik (1953) then studied discrimination of length by sight and touch and on the basis of their results concluded that ".... it is doubtful if cross modal matching is ever more than an experimental artefact". Yet both Kelvin and Jastrow agree that it is expressing rather than the receiving sense that determines the nature of the results.

Similar researches were conducted by Rice, James and Brodsky (1972) on the 'Effect of Visual and Tactual Stimulation on Learning of Abstract Forms'. Results are

interpreted as indicating the superiority of visual information processing. Combining visual and tactual stimulation resulted in decreased performance.

McDonnell, Paul and James (1972) sought to resolve the conflict between the two senses of vision and touch. Although many studies have supported Rock and Victors conclusion that visual tactile conflict will be resolved in favour of vision, Mcdonnell's etc. study presents evidence that methodological problems may have produced a bias in favour of vision. Results indicate that the generalization of vision as a dominant modality may be premature.

Related studies have been conducted by Appelle Stuart (1971) and Dougherty, Jones & Engell (1971). The first investigator examined discrimination of form for angularity and the nature of intra and cross modal matching experiments. Results suggest that haptic percepts of angle were smaller than those for vision. The second group of investigators based their study on "sensory integration of auditory and visual information". Results are consistent with a model in which bisensory processing occurs independently.

In previous experiments, the problems of perception in conditions of 'intersensory' stimulation, it has been suggested that information about the positions of stimuli in space be handled by a single integrating framework located

in the central nervous system. Accordingly, experiments were conducted in both intrasensory (first and second stimulus in the same modality) and intersensory (first and second stimulus in different modalities) conditions. If a visual stimulus is brought toward another which moves away on apparent impact, subject describes that second stimulus as in some way set into motion by the first. This phenomenon has been interpreted as a basic element of perception. It should follow that this experience is also available in nonvisual senses which handle spatial information and that it should be evident in 'intersensory' conditions. Experiments were conducted. Forty six out of fifty one subjects made a casual response. Once a casual response was made it was not changed. The findings appear to support the presence of a central integrating system (Fisher 1962).

Another study was undertaken (Mohanty, Das and Srivastava 1971) to determine the manner in which intersensory transfer takes place in the performance of jobs involving different sensory functions. The sensory functions relating to visual, tactual and motor systems were selected for study. Findings suggest that for efficient learning of skilled and semi-skilled jobs, the visual and tactual functions involved in them should be kept as discrete as possible.

If tactual cues are to be utilised it is appropriate to determine whether additional factors play a part in subjects

ability to discriminate. The purpose of Austin and Sleights (1952) experiments was therefore to determine, if speed and accuracy of tactual discrimination was related to or affected by differences in sex, handedness, learning, pressure exerted by the fingertip and levels of subjective confidence. The results of the experiment seems to warrant the conditions that a great deal of learning took place during a short session as shown by a marked increase in accuracy and decrease in RT as levels of subjective confidence increased accuracy increased, and RT decreased throughout the total period, in approx. 99% of the discriminations pressures from 0 to 3 ozs. were exerted in making the discriminations, and, no significant differences resulted from discriminations made by left versus right handed subjects, males versus females, or any of the four right handed figures.

Bernstein (1970) proposed a parallel processing model of sensory interaction in RT, derived from the physiological distinction between specific and non-specific input systems. An informational system is assumed to perform pattern analysis and is limited in part to input from a single sensory modality at a time (Kristofferson 1967). In contrast, a second, or energic system is responsive to stimulus intensity and is concerned with response preparation.

A study conducted by Holden (1970) shows adolescent educable retardates (R), equal chronological age (CA) normals

and equal mental age (MA) normals reported the number of pulses in varying length sequence presented to the same (visual, auditory or tactile) modality, alternated between two modalities, and alternated among these modalities. Errors increased numerosities and from the unimodal to multimodal conditions. Compared with both normal groups, retardates underestimated relatively more than they overestimated. This confirms previous findings that retardates process incoming stimuli more slowly than normals.

Studies of numerosity perception of stimuli presented sequentially within the auditory, visual and tactile modalities (White and Cheatham 1958) have consistently demonstrated increasing underestimation errors as the number or rate of stimuli within a sequence increases.

Research on the facilitation and inhibition of sensation in one modality due to stimulation of other sense organs has had a long but controversial history. Of interest in connection are a number of reports from Russian laboratories (Chapanis, House and Schlachter 1949) which claim to show enormous effects in interoceptory stimulation on dark adaptation and night vision. Thus Kekcheyev reports "several months ago we experimented in expediting adaptation by means of light muscular exercise....Experiments made on subjects with the help of the adaptometer revealed that it was possible in this way to reduce the period of adaptation from 24-45 minutes to 5-6 minutes." Kekcheyev (1970) then goes on to say that

auditory, olfactory, gustatory, labyrinthine, thermal, pain, tactile proprioceptive and interoceptive stimuli produced changes in the sensitivity of the dark adapted eye. Ref No. 113

Symmetry of cross modal transfer was investigated by training college students to discriminate irregular heptagons from transformations either visually or tactually, and then repeating the procedure with the other modality. Comparisons with unimodal control groups indicated that visual training increased the accuracy of identifying equivalent primary forms by touch. No transfer effect was detected from touch to vision, although the difficulty of visual and tactual discrimination was approximately equated. This finding contradicts a common belief that cross modal transfer is superior from touch to vision in normal adults.

Experiments with human adults hence show that cross modal transfer of training in form perception can occur both from vision to touch and in the reverse direction (e.g., Eastman 1967, Farrill and Holander 1963). However, the relative extent of transfer across modalities is observed by the particular method employed. The subjects are first required to learn specific response labels for the items, presented either tactually visually, according to a paired associate paradigm. The task of associative learning may be considerably more difficult than the task of stimulus discrimination. Upon switching the mode of stimulus presentation to test transfer,

it is usually found that visual presentations elicit more correct responses than do tactual presentations. Such results have been interpreted as indicating superior transfer from touch to vision but it is apparent that the discrimination task may simply have been easier by vision than by touch (Lobb 1965, 1968). It is perhaps impossible to evaluate the relative amounts of cross modal transfer vigorously when so much associative learning is confounded with the discrimination task. The question of possible asymmetry is important in elucidating the relationship between vision and touch.

The relationship between the localisation of heard sounds and simultaneous visual impression is illustrated by an observation of S.L. Rubinstein. "At a certain meeting, the speeches were transmitted through several loudspeakers suspended along the right and left walls. At first, sitting rather far and being near sighted, I could not recognise the Speaker's voice (which I knew quite well). After a while I saw who it was, or rather, noticed him make several successive movements with the hand coinciding with the accents of his voice. And immediately its sound shifted - now it came to me straight from the front from the place where the speaker was standing (and not from the nearby speaker). During the recess, I changed my seat for one in the rear on the right, from which I was totally unable to watch the orator, or rather, I could vaguely discern his figure, but could not make out

whether he was speaking (the movements of his lips gestures, etc.), the sound of his voice stopped coming from the rostrum, as was the case before the recess, and again shifted to a loudspeaker, this time on my right. Trying not to disturb my neighbours, I moved forward, nearer to the speaker. At present there was no change in the direction of the sound. But then I looked hard and suddenly noticed the speakers gestures, i.e., saw in front of me a man making a speech. At that very moment the sound shifted forward towards the rostrum, and I began to hear it from the place where I saw the man himself. When the next speaker went forward I followed him with my eyes, noticing that as soon as he mounted the rostrum the sound of his voice became audible from it. During his speech I began making notices and lost sight of the orator. On finishing my notes, I was surprised to notice that the speakers voice now came not from the front, where he stood, but from my right, localising in the nearest loudspeaker. In all, during that meeting, the sound of speeches shifted about 16 times with invariable regularity. I moved towards the rostrum or back again to the nearest loud-speaker depending on whether I saw the man speaking (moving his lips and hands) or not. In particular, when the speaker began to gesture and I saw he was speaking, the sound shifted towards him, i.e., I heard him from the rostrum. But when the orator stopped gesturing and I could not see him speak, the sound went back to the

loudspeaker and I must state that I did not conceive the sound, but perceived or rather sensed it alternatively in front or beside me". Ref. No. 113

There is some evidence that the concept of a hierarchical structure of sensory systems is connected with the developmental process in children. Amongst others Renshaw (1930), Zagorozhets (1961) and Birch (1962) used this concept. According to this theory interoceptive and visual sensations are dominant in the young child, and this dominance is gradually superseded first by tactile and kinaesthetic and then by the telereceptors, i.e., the auditory and the visual sensory systems. A parallel process is the gradual establishment of the equivalescence and integration of different sensory information, so that stimuli to one sense can be readily recognised and interpreted in another. Such concepts are of interest for investigating responses to environmental stimulation in psychotic or artistic children. Goldfarb (1956) has suggested that schizophrenic children make contact with their environment through the proximal rather than the distance receptor channels. The relative dominance of different receptors may be important for the control of behaviour of such children in an experimental environment.

Upto this point a number of facts doubtlessly confirming the interaction and intercommunication of the

sense organs have been reviewed. These facts which are established by special experiments and observations concern almost all the sensory systems. The next part of the review centres on the existing studies on the relationship between sensory interaction and personality variables.

The evidence regarding the relationship between sensory interaction and personality is not direct. In the absence of direct data regarding such a relationship, certain assumptions based on studies correlating conditioning, flicker fusion and the like inter personality have been made. A brief review of the work done in the fields of conditioning, flicker fusion and figural after effect given below reveals that these have been found, in some way or other, to correlate with some aspects of personality such as anxiety, extroversion-introversion, or a particular level of emotionality of a subject. A similar assumption could be indirectly made in the present study, where, it may be assumed and hypothesised that greater ease in intermodality transfer is a reflection and representation of certain dynamic state of personality.

Hull (1943, p.47) offers evidence to suggest that behaviour is a function of two principal classes of variables - learning and motivational. These two variables are supposed to combine multiplicatively according to the formular - $R = f(sHR) = f(D \times sHR)$. Spence and his colleagues (e.g.,

Spence and Farber 1953, Spence and Taylor 1951, Taylor , 1951) have adopted Hull's model, in particular the above equation to make predictions about eyelid conditioning. They argue that the total effective drive strength (D) is in part function of the level of internal anxiety or emotionality of the subject; consequently subjects with a greater degree of anxiety would possess more drive and therefore form conditioned responses better than subjects with a lesser degree of anxiety.

An entirely different theory has been developed by Eysenck on the basis of certain Pavlovian concepts and hypotheses (Pavlov's original observation was to the effect that neurasthenics possessed an exaggeration of the inhibitory process). Retaining the notion of excitation and inhibition potentials as determining $_{S}H_{R}$, Eysenck has postulated individual differences in the development of these two potentials and linked these differences with the personality development according to the following postulate : "Individuals in whom reactive inhibitions are generated, and in whom reactive inhibition is dissipated slowly are thereby predisposed to develop extroverted patterns of behaviour and to develop hysterico-psychopathic disorders in cases of neurotic breakdown, conversely, individuals in whom reactive inhibition has developed slowly, in whom reactive inhibitions are generated, in whom reactive inhibitions is dissipated quickly, are

thereby predisposed to develop dysthmic disorders in cases of neurotic breakdown".

The well-established finding (Spence and Welch and others) that anxious subjects condition better than non-anxious may be explained either in terms of Spence's theory of superior drive level or in terms of Eysenck's theory of inhibition - excitation and extroversion-introversion. Eysenck has established that anxious subjects are more introverted and more neurotic than normal subjects. A crucial experiment would be one for which each theory would predict different results. One such experiment is that in which drive is manipulated, while introversion-extroversion remains unaltered. Spence's theory would predict a change in conditionability, Eysenck's theory would predict no change. To increase drive a group of normal male subjects were deprived of food, drink and tobacco for 24 hours, while another similar group were allowed to eat, drink and smoke in their usual manner. It was found that both groups conditioned equal well. Another crucial experiment would be one which conditioned equal well. Another crucial experiment would be one which examined the conditionability of three groups, namely, normals, introverted neurotics (anxiety states) and extroverted neurotics (hysterics and psychopaths). Spence's theory would presumably predict that both groups of neurotics would condition better than the normal group (the assumption being that neuroticism or high

high emotionality may be associated with high drive). Eysenck's theory would predict that the introverted neurotics would condition best, the extroverted neurotic worst, and, that the normals - being as a group neither extroverted nor introverted would be intermediate in their ease and strength of conditioning.

The conditionability of sensory responses adds immensely to the range of sensory interaction and is considered a factor to be reckoned with, though the accessory effect is not native but acquired. Work on conditioned "sensory reflexes" dates back to 1936 when Kravkov , Bogoslovskit and Dolin Ref. No. 115 independently demonstrated the conditionability of change in visual responses. Thus it was early shown that it is possible to condition changes in electrical sensitivity of the eye, critical flicker frequency, peripheral sensitivity etc. to such indifferent stimuli as ticking a tone to elapsed time of eye exposure to the dark.

To illustrate some of this work, Polonia Ref. No. 113 managed to induce change in internal sensation in response to accessory auditory stimulation by making of the latter a conditioned stimulus. Dobriakova conditioned increased of gustatory sensitivity to the ticking of metronome after having associated the latter with light - a stimulus which ordinarily induces a positive accessory effect on gustatoryx sensitivity. In addition, it was found that symbols, denoting stimuli which

heighten gustatory sensitivity, make manifest like effects. A general heightening of various visual and auditory sensitivities has been observed to ensure through mere presence of a subject in the experimental room. Frequent prior presence in the room while in a state of intense attention is said to condition modification of visual and auditory sensitivities to the sight of the experimental room - the state of attention being thought of as in the role of "Unconditioned stimulus". From the foregoing discussion on the phenomenon conditioning a conclusion may be drawn that conditioning is correlated with anxiety, introversion and emotionality, in other words, certain attributes of personality.

On a survey of the relationship between the phenomenon of Figural-after-effect and personality it is revealed that the occurence of figural after effect in any sense modality has been explained in terms of satiation (Kohler & Wallach), in terms of reactive inhibition (Eysenck 1955), in terms of critical conductivity and critical modifiability, and is considered to be representing the general function of the brain processes. But the findings (Gardner 1961, Lipman and Spitz 1961) have cast doubt on the general factor theories of brain processes and Spitz and Lipman have commented that if high correlation does not infact exist, then a re-examination must be made of any theory which employs after effects as an operational index of generalised individual differences in

brain functions. Further Eysenck's postulate of positive relation between extroversion score and size of figural after effects has been found wanting by the recent findings (Bakan, Myers and Schonnard 1962, Becker, 1960, McEwen and Hodger 1960, Nichols 1956, Limpan & Spitz 1961, Rechtschaffer & Bookbinger 1960). In other words all these studies point to the fact that an aspect of personality namely extroversion is supposed to be a determining factor in figural after effect.

Jaffe (1956) questioned the assumption of the isomorphic representation of electronic activity in the primary projection areas as put forth by Kohler and Wallach in 1944 on the basis that "if satiation is restricted to the primary projection areas, FAE should not be demonstrable when both the antecedent stimulus and the stimuli used to test for the after effect are presented to the same sense modality". He found that the concurrent visual stimulation can induce a significant kinesthetic after effect but this after effect appears only when contrasting size ext relationships exist between the visual stimuli. Research on sensory interaction in the Soviet Union reviewed by London (1954) clearly demonstrates modification in the response in one sense modality without any size relations between the stimuli. H.K. Pauls study (1964) confirms Eysenck's hypothesis that extroverts elicit stronger FAE, except a minute indication that the males

on the whole elicited larger FAE and also have greater average scores on extroversion. Paul's study, however, contradicts Jaffe's conclusion that concurrent stimulation would influence after effects only when there were contrasting size relationships between the stimuli.

Another phenomenon found to be related with personality is critical flicker-frequency (c.f.f.) is defined as the frequency at which an intermittent light appears fused on 50% of the trials. Kravkov observed the c.f.f. for greater flicker to fall during sound stimulation, whereas for orange red it grew. Kravkov carried out an exhaustic study of c.f.f. changes for various monochromatic spectral rays under the influence of olfactory stimuli, viz., the odours of bergamot oil and geranoil. The brightness of flickering light illuminating the central retina was so adjusted that with stable dark adaptation the c.f.f. was approximately 12,13 cps. The experimental results were quite definite. During olfactory stimulation the c.f.f. for green-blue dropped, whereas for orange-red it rose. After stimulation ceased the c.f.f. not only returned to the initial level observed before inadequate stimulation, but often changed still further in the same direction, reaching a phase which was the reverse of that observed during stimulation. A similar picture of changes for various monochromatic light rays was obtained by Dobrayakova (Ref. No. 113) under temperature and gustatory stimulation. The gustatory stimulus

applied was sugar, and the temperature stimulus — heat. Such change elicited by indirect stimuli acting on other sense organs were observed only at brightness corresponding to a critical fusion frequency of 12-13 cps. If we apply a considerably brighter light corresponding to say 26-30 cps, the, as demonstrated by Kravkov, the same indirect stimuli may alter the c.f.f. for weak light is reduced by the given indirect stimulus, for considerably brighter light it may be increased.

Eysenck (1951) measured the flicker threshold with a Dawe Stroboflash, consisting of a neon tube which can be made to flash intermittently at frequencies of from 600 to 14,5000 flashes per minute. Testing was carried on and results indicate that the mean scores of normals were the highest, introverts exhibited a little less and the extroverts the least mean scores.

One of the minor controversial topics in psychology has been about the location of mental sets. Does the neuro-physiological process which exercises a selective control in motor behaviour or in perception involves the effector or the receptor apparatus of the nervous system, or does it operate centrally. Mowrer (1940, 1941) presented the findings of his experiments on motor set in support of the central theory, but his interpretation of the studies was subsequently disputed

by Gibson (1941). Some work in the neurophysiology of perception (Kuffler & Hunt 1952, Galambos 1956, Granit 1953) demonstrates that the mechanism operates at both levels. Meanwhile, psychologists too, have intensively studied the selected process in perceptual expectancy, i.e., set in a sense distinct from readiness for a motor response. Their experiments usually require the subject to reproduce stimuli presented at or near the threshold level. A common method of establishing sets or expectancies is that of defining, for the subject, the class from which the forthcoming stimuli will be drawn, e.g., pictures of fruit, or names of capital cities. Experiments have shown that identical figures can be perceived as a letter or a number (Bruner and Mintburn 1955), as an animal or a mountain scene according to the expectancy, and not be recognised as a figure perceived in accordance with the alternative set (Zangwill 1937). Most of the experiments have used tachistoscopic material, and even though the expectancy is established by auditory verbal instruction, confirmation proceeds in the same modality as its test, i.e., visually. Presumably the set operates at a neurophysiological level which is common to both sense modalities, i.e. centrally. Nevertheless, it can be argued, that since all stimulation affects one special sense organ, the set operates by lowering excitatory thresholds in that receptor. Concepts must be formed by some central process, but once formed they could

theoretically operate peripherally, as suggested by the work of Lacey and Smith (1954) whose subjects conditioned anticipatory autonomic responses generalised by means of unverbalised conceptual associations.

The foregoing review on the phenomenon of conditioning, figural after-effects, critical flicker frequency, mental sets, and reaction time reveals that all these are in a way related to personality, or rather certain personality traits reveal these tendencies in a better way than others. It may be assumed that there are individual differences in the transfer capability also depicting a certain 'type' or 'style' of assimilating and transfering information from a certain stimulus input. It may, therefore, be hypothesized that an individual who is capable of easy inter-modal transfer is an individual with an "open mind", and his personality is flexible. He is efficient in handling and taking in the learning and stimulation through one modality and through proper channel, transforming it into learning of another modality. The mutual influence between sense organs is easy and smoothgoing and the personality flexible. On the other hand, an individual who is not skillful in transfering the learning of one modality into learning of another modality is a person with a 'closed' mind, introverted, and his personality is rigid. Such an individual is remarkably impermeable to contradictory evidence. Often he simply does not see behaviour, or hear

speech, which does not fit in with this conception of a person, such as he does not see an object placed in an unusual context in the game of Hunt-The Thimble. The purpose of the present study lies in the uncovering of the above assumptions.

In the attempt to comprehend the nature of the modifications of sensory response induced through accessory stimulus, ~~central~~ general conditions have been put to theoretical work. Analysis of the relationships allows an investigator to draw certain general conclusions, to outline certain laws of interaction between sense organs. These conclusions refer, primarily, to the routes and means by which such interactions may be effected. The following are some of the conditions which facilitate sensory interaction.

The Strength of the Accessory Stimulus or Indirect Stimulus- Increase of accessory stimulus leads frequently to effects that are reverse of those induced by weaker intensities that one can almost speak of a rule of "inversion". For example, sounds of weak intensity heighten the electrical sensitivity of the eye, while those of increasing intensity are accompanied by a gradual decline. However, Krawkov (1946) doubts the generality of any "rule of inversion" and points out in one case where the rule itself is controverted. Varying the intensities of sounds employed as accessory stimulation he found that an increase from 85 db to 95 db was paralleled

by a steady increase of sensitivity to green light (530 mμ) and a steady increase to orange light (590 mμ), findings which deny a general "rule of inversion".

Excitatory State of Primary Sense Organ - The effects of accessory stimulation depends not only on the intensity of the accessory stimulus, but also on the initial degree of excitation of the sense organ undergoing primary stimulation. Thus, in order to increase the loudness of a tone on accessory visual stimulation, the initial loudness must be sufficiently great. Otherwise, either no effect will be demonstrable or a loss in loudness will ensue.

Duration of Accessory Stimulation: Intensity of accessory stimulation is not the only factor of importance, duration is also important. Krawkov (1946) has shown that as a rule accessory effect becomes increasingly prominent during the first moments of accessory action. But subsequently the effect very often drops away from the maximum attained, for example, accessory auditory stimulation was applied for an hour while the eye underwent simultaneously 31-61 minutes of dark adaptation. Critical flicker frequency was found during this period ~~of~~ to rise sharply but to diminish after a quarter from the maximum previously obtained.

Termination of Accessory Stimulation : In describing the influence of accessory stimulation on a given sense organ, it

is of course necessary to stimulate whether the state of the latter is tested before or after cessation of accessory stimulation, since, after withdrawal of the accessory stimulus, its effect does not just wear off with an eventual return to normalcy. There frequently arises, instead, a shift in a direction opposite to that of the initial effect. Lowered sensitivity may be followed by a super normal phase, heightened sensitivity by a subnormal phase. For example, Kravkov (1946) observed that sound lowers c.f.f. for peripheral vision. After its termination, however, be noted that under the same experimental conditions c.f.f. phenomenon is raised, sometimes markedly.

Affectively of the Stimulus : It appears that stimulus affectivity is a factor to be reckoned within sensory interaction. For example, it has been claimed that where gustatory and olfactory stimuli of unpleasant character are applied as accessory agents, peripheral sensitivity of the eye declines. It is also reported that colour sensitivity of the dark adapted eye to red and yellow is raised, to green and blue lowered, whereas disagreeable sounds reverse the effects (Kravkov 1946).

Physiological State : The specific state of the sense organs as well as the more general state of the individual plays a role in sensory interaction. A number of experiments

may be mentioned by way of examples. Presence of a subject in a green illuminated white room heightens auditory sensitivity, whereas presence in a red illuminated white room brings about a decline. However, on changing the physiological state of the organism through moderate dosage of veronal, the experimental effects are precisely reversed. Similarly, it has been demonstrated that with intense auditory stimulation the electrical sensitivity of the light adapted eye undergoes decrease and that of the dark adapted eye increase. Electronic stimulation of the eye with nodal contact induce similar effects, with antinodal contact, however, reverse effects show up.

Continuity : Over a considerable range of auditory and visual stimuli certain visual and auditory responses undergo intensification through respective accessory reinforcement via intermodal action. To explain a number of them such as the increase in visual acuity of one eye upon normal stimulation of the contralateral ear, recourse has been had to the neurological map. In the region of the corpora quadrigemina the visual and auditory nerve fibers are in close proximity and myelin free. Since nerve action in one unmyelinated fiber is held likely to influence that of another contiguous to it, the feasibility of excitatory irradiation through contiguity of the conducting fibers is considered to be demonstrated. Similar considerations are thought to make

olfactory influence on vision understandable, for in the region of the stratum zonale and nucleus anterior thalami the visual and olfactory nerve fibers lie in close proximity. Thus the olfactory apparent system may likewise have its effect on visual phenomenon through excitatory irradiation.

Neural Excitation : It had been established that sensitivity of central vision to orange-red light declines with simultaneous auditory stimulation, i.e. to say, a rise of threshold in decrease of excitability takes place. Kravkov reasoned that, if an accessory auditory stimulation positive irradiation could be demonstrated to intensify for an object of orange-red hue (if its apparent size was increased) then change in neural excitability but in neural excitation must be decisive for achieving the observed effects.

Levelling and accentuation: This consists of taking note of the initial contrast between the viewed object and its background. It was shown that with simultaneous auditory stimulation visual irradiation of a white object against a black background intensifies, while what of a grey object against the same background diminished. The rule of levelling and accentuation provides : where initial contrast is large, accentuation of contrast occurs, where it is small, levelling or reduction of contrast results.

Intracentral mediation : An accumulation of experimental data as well as the anatomical richness of intracentral

connections made natural the consideration of intracentral mediation as a factor in sensory interaction. Certain specific research seemed also to suggest the intracentral mediational character of accessory action. For example, in the course of registering the bioelectrical currents in the auditory region of the cerebral content of rabbits, it was discovered that these currents are modified in an interesting fashion, should the eye be exposed to regular flicker : the rhythm of electrical potential in the auditory region comes, after an interval, to correspond to that of the flicker (Livanov 1940). Ref. No. 13

The connections between different nerve centres may be either conjugate or antagonistic. There are numerous facts which testify to the existence of antagonistic, i.e. reciprocal relationship between certain sensory modalities. These include, primarily, pain and coarse temperature sensitivity on the one hand and tactile sensitivity on the other. Head in his well known experiments observed changes of skin sensitivity after severing one of the sensory nerves in his own hand. During gradual recovery from the operation Head noted that at the initial stage fine tactile sensitivity was totally absent in the skin area innervated by the severed nerve, but temperature and pain sensations arose as before. The latter, however, were of somewhat unusual nature, always extremely intense and hard to localize, i.e., diffuse. But

with the recovery of fine tactile sensitivity, the pain and temperature sensations lost their hypergathetic and diffuse character. There was reason to suppose that fine tactile sensitivity had an inhibitory effect on the reactions of nerves responsible for pain and temperature sensations.

Ionic Balance : It has been pointed out that under an electronic influence central sensitivity of the dark adapted eye to green blue is increased to orange-red decreased, whereas under catelectronic influence the reverse is observed. Attempts to explain the results of electronic influence have been generally based on considerations of ionic concentration and balance.

Autonomic Nervous System : A variety of accessory stimuli such as touch, a voice, the taste of sweetness, the odour of bergamot oil and camphor has been reported to produce similar differential effects on retinal sensitivity to green-blue and orange-red lights, heightening sensitivity of the latter (Kravkov 1946). This circumstance led researchers to look for a common factor behind this discerned uniformity of differential action. They noted that application of the above stimuli was accompanied by a quickening of the pulse, and it was conjectured that the common factor might be the autonomic nervous system, in view of the fact also that the odour of thymol, which reverses the differential effects was found to reduce pulse rate.

Modification of Primary Conditions : Accessory stimulation is held to produce its effects in many instances in ways not involving considerations of excitation or excitability of the primary sensory system. These refer to accessorily induced modifications of the physical conditions under which primary stimulation is applied. For example, the pupillary reflex may respond to an auditory stimulus. Here the quick contraction of the pupil with its slow subsequent relaxation would be expected to modify some aspects of the visual function. Since the amount of light entering the eye is affected by pupillary width, upon nonemployment of an artificial pupil apparent changes in the visual threshold which follows upon auditory stimulation may be ascribable not to changes in excitation or excitability of the visual afferent system, but rather to changes, induced by accessory stimulation, in the physical conditions. Since the pupillary reflex is not without effect on accommodation, visual acuity also may undergo modification owing to the accessorily induced changes in the physical conditions accompanying primary stimulus action. Similarly, pain, vestibular stimulation etc. modify the pupillary reflex and thereby may give rise to stimulated accessory effects. Another, e.g., tactile stimulation around the ear appears to affect auditory threshold, but the result of such stimulation might more aptly be ascribed to reflex changes in the small muscles controlling the tension

or the bony system of the middle ear than the changes in the auditory afferent system (Krasnov 1948).

Conditioning: The conditionability of sensory responses adds immensely to the range of sensory interaction. Work in the Soviet Union on conditioned "sensory reflexes" dates back to 1936 when Krasnov and other demonstrated the conditionability of changes in visual responses. To illustrate some of the work Pshonik managed to induce changes in auditory stimulation by making of the latter a conditioned stimulus.

It is obvious that the formation of sensory connections open infinite opportunities for mutual influence between sense organs.

CHAPTER III

STATEMENT OF THE PROBLEMS AND HYPOTHESES

CHAPTER III

STATEMENT OF THE PROBLEM AND FORMULATION OF HYPOTHESIS

How does previous learning affect subsequent learning ? Ever since William James discovered in 1890 that practice in memorising Milton's 'Paradise Lost' did not produce any improvement in his memorisation of French poetry, transfer in learning has been one of the most popular topics for educational - psychological research. At first, there was a rush of concern as to whether in fact transfer was present in the school curriculum, whether it was positive or negative and to what degree. As is often found in other fields of scientific enquiry, increasing attention began to be shown to the exact conditions under which transfer occurred. Interest in intersensory transfer also arose and a large number of studies (outlined in the previous chapter) were conducted. Both, the characteristics of the learning situations and the characteristics of the learners came under study. The concept of transfer itself became broader as it was realised that all learning involves transfer through time, even from learning trial to learning trial of the same task.

The review of literature on intersensory transfer presented in the previous chapter reveals that transfer does undoubtedly exist. That some individuals are more adept than others is a question which may be answered by an analysis of

the 'make-up or 'personality' of that individual. This fact emerges from personology which grew out of differential psychology, the psychology of individual differences. The first efforts of this psychology were devoted to finding empirical generalisations and abstract laws about such functions as sensation and perception. It was what Boring called the science of the average, healthy, adult mind.

, It is widely agreed that personality rests on a firm hereditary basis, but is also subject to great alterations through social and other environmental influences. It would appear, by and large, that personality tests of the objective performance type are related rather more closely to the inherited pattern of a person's conative and affective traits; tests of conditioning, of suggestibility, of autonomic imbalance, of sensory dysfunctioninge and of motor expression appear to closely bound up with the structural properties of the nervous system and with the body build or the sensory equipment of a person that the likelihood of hereditary determination can hardly be gainsaid.

It has been assumed on the basis of work done by Klein (1951) that there exists a particular kind of 'style' in transferring learning gained from a specific stimulus object. Klein has suggested a distinction between sharpeners and levellers - those who tend to accentuate unusual features,

say in perceiving a diagram, and those who level down such features so as to make the perception more conventional and acceptable. Assuming such a relationship between sensory transfer and personality is purely hypothetical: there is yet little convincing evidence to prove that they are linked in any way. Indeed it is by no means certain that these personality traits are consistent or general over a wide range of visual and tactual phenomena. On this assumption it is hypothesised that greater facility in transfer is representative of greater intelligence, lesser greater intolerance of ambiguity, greater kinaesthetic figural after effect, greater extroverted tendencies and less rigidity. How each variable has been formulated to establish a relationship with transfer will be dealt separately. This study has been undertaken to study the intermodal transfer between vision and touch and further try to establish a certain relationship between this transfer and certain personality traits. The hypotheses formulated are presented in the following pages. There are five main hypotheses and one secondary hypothesis.

Main Hypotheses -

(1) Intelligence. There are a variety of definitions offered by psychologists. One group of definitions emphasises the adjustment or adaptation of the individual to the total environment. According to such definitions, intelligence is

a general mental adaptability to new problems and new situations in life.

Another group of definitions, places emphasis on the ability to learn, hence a person's intelligence is a matter of the extent to which he is educable in the broadest sense.

Still a third group of definitions tries to define intelligence as the ability to carry on abstract thinking. This type of definition embraces the use of concepts and symbols. Binet's conception of intelligence falls in this category, for, according to him intelligence is the capacity to reason well, to judge well and to be self critical.

A comprehensive definition has been offered by Weschler "Intelligence is the aggregate or global capacity of the individual to act purposefully, to think rationally and to deal effectively with his environment.

According to Stoddard : "Intelligence is the ability to undertake activities that are characterised by (i) difficulty (ii) complexity, (iii) abstractions, (iv) economy, (v) adaptiveness to a goal, (vi) social value and (vii) the emergence of originals that demand a concentration of energy and a resistance to emotional forces".

Some psychologists believe that several kinds of intelligence should be distinguished from one another. Noteworthy

among them is E.L. Thorndike who has divided intelligent activity into three types (i) social intelligence or ability to understand and deal with persons, (ii) concrete intelligence, or ability to understand and deal with things as in skilled trades and scientific appliances, (iii) abstract intelligence or ability to understand and deal with verbal and mathematical symbols.

The definitions so far given are functional in character i.e., they state how intelligence operates : through learning, adaptation, abstract thinking. But in addition, efforts have been made to know the 'structure' of intelligence, i.e. to determine its underlying factors. Thorndike's multifactory theory, Spearman's two factor theory and Thurstone's Group Factory theory are all attempts at understanding the elements or components of intelligence.

In a study conducted by Ewart, Anne and Carp (1963) it was found that a significant interaction existed between vision and I.Q. But the analysis indicated no significant effect of vision, I.Q. or CA on test scores. Another study on 'effect of sensory input on severely disturbed artistic children and on subnormal controls' was conducted by Hermelin, Beate and O'Connor (1964). It was found that sensory dominance in children differs with age development and experience and

may be a diagnostic differential in the case of autistic children. It was also found that autistic children did not learn to suppress a previously dominant stimulus orientation habit as quickly as the control group of imbecile children.

The role of the CNS in the communality and consistency in the multimodal psychophysical judgement was studied by Majumdar and Ranjit (1970). Three sensory modes were studied with brain damaged and nonbrain damaged individuals. Significant correlations were obtained in visual and auditory modes but not in the vibratory touch mode. Lack of correlations was also obtained in the brain damaged group showing the role of the CNS in the consistency of psychophysical judgement.

The above studies reveal that some sort of relationship does exist between I.Q. and sensory functions. Indeed Ewart, Anne and Carp have reported a significant relationship. Based on this conclusion it was hypothesized that there should be a positive relationship between the subjects' intelligence level and transfer scores. In other words if a subject is capable of greater ease of transfer his I.Q. would also be high.

(2) <u>Intolerance of Ambiguity</u>. Intolerance of ambiguity may be defined as the "tendency to perceive (i.e., interpret) ambiguous situations as sources of threat, "and tolerance of

ambiguity as the tendency to perceive ambiguous situations as desirable". Two elements in this definition require further clarification "nature of ambiguous situation" and meaning of "to perceive as source of threat". The term ambiguity means that which can have more than one meaning or of doubtful meaning. An ambiguous situation may be defined as one which cannot be adequately structured or categorised by the individual because of the lack of sufficient cues. It is possible to identify three such situations - a completely new situation in which there are a great number of cues to be taken into account, and, contradictory situation in which different elements of cues suggest different structures - in short, situations characterised by novelty, complexity and insolubility.

The background of the problem became related to the vast fund of knowledge supplied by psychoanalysis in connection with the development of the concept of "ambivalence", as defined by the co-existence in the same individual of love and of hate cathexis toward the same object. The existence of ambivalence in a person and the further fact of this persons ability to face his or her ambivalence towards others is considered to have an important personality variable. There is evidence of individual differences both in emotional ambivalence and the readiness to face it and in the more cognitive recognition of traits of conflicting values in

others. Some individuals are more apt to see positive as well as negative features in their parents and can accept feelings of love and hate toward the same persons without too much anxiety and conflict. Others seem compelled to dramatise their image of the parents in seeing them either as altogether good or as altogether bad. We infer that the individual was repressed the negative side of an ambivalence out of some hypothetical intolerance of ambiguities and complexities.

The interest exhibited by psychologists over the past years in the concept of tolerance-intolerance of ambiguity derives primarily from Frenkel-Brunswik's attempts to establish the relationship of this variable to the authoritarian syndrome (1949,1951). The greater part of the research conducted since Frenkel-Brunswik's initial formulation has been focused upon the nature of this relationship, and possibly because of this almost exclusive concern with one problem, the results of much of this research have been inconclusive (reviewed by Budner 1960).

The problem of defining, or more accurately, of identifying tendencies to perceive as sources of threat may be approached as follows : Response by individuals to stimuli take place on at least two levels, the phenomenological and the operative, the former is the world of individual perceptions and feelings, the latter is the world of natural and

social objects. On the one hand, the individual perceives, evaluates and feels, on the other, he behaves or acts in some manner with reference to the external environment. By obtaining indicators of response, on both levels, it is possible to achieve a more accurate estimate of an individuals tolerance-intolerance of ambiguity than can be derived from indicators limited to only one level of response. Hence for the two levels, what reactions suggest perception of threat. The range of possible reactions to threat may be dichotomised crudely with submission and denial. By submission it meant the recognition of the situation as an ineluctable fact of existence which the individual cannot alter. By denial it meant the performance of some act by which the objective reality, even if only in the phenomenological world of the individual, is altered to suit the desires of the perceiver. Thus, if an individual exhibits any one of the following types of response - phenomenological denial (repression and denial), phenomenological submission (anxiety and discomfort), operative denial (destructive or reconstructive behaviour) or operative submission (avoidance behaviour) — it seems plausible to infer that he is in some way threatened. If these behaviours are elicited by situations characterised by novelty, complexity or insolubility it would seem reasonable to infer that the individual is intolerant of ambiguity.

Experiments on perceptual ambiguity were conducted by Frenkel-Brunswik and it was found that intolerance of perceptual ambiguity is related to a broader psychological disturbance of which prejudice is another manifestation. Regarding intolerance of perceptual ambiguity according to Klein there is a tendency in people not to see uncertainty or ambiguity. People modify their judgements of perceived object to conform to the judgement of a social group or opinion expressed by the members of the group.

Intolerance of ambiguity has some similarity with 'Cognitive dissonance'. According to Festinger (1957) an individual experiences discomfort when he holds logically inconsistent cognitions about an object and he is thus motivated to reduce the dissonance through cognitive and attitude change. Researches have been done on intolerance of ambiguity in the area of perception and thinking and it is also studied as an emotional and perceptual personality variable.

Concentrating on tolerance versus intolerance of ambiguity, the question takes the form as to whether those incapable of conflicting emotions - or of conflicting value, judgements are generally incapable of seeing things in two or more different ways. Ambiguity of cognitive response must be seen as a reflection of the uncertainties existing in the environment.

To quote from the theoretical considerations in an advance report of 1946 Frenkel-Brunswik have been led to "expect prejudice to be associated with perceptual rigidity, inability to change set and tendencies to primitive and rigid structuring of ambiguous perceptual fields. Well tested experimental approaches are available for these variables". It was found that extremely prejudiced subjects received high ratings on traits as intolerance of ambiguity", "rigidity", and "distortion of reality".

Intolerance of ambiguity is further related to a reluctance to think in terms of probabilities and a preference to escape into whatever seems definite and therefore safe.

Regarding measures of intolerance of ambiguity - Budner made a 16 item Likert Scale of tolerance-intolerance of ambiguity and rigidity. Three scales are designed to measure intolerance of ambiguity. Coulter Scales made by Eysenck in 1954, the Walk's scale made by O'Connor in 1952, and the Princeton Scale developed by Saunders in 1956. In general the measures inter-related at a level high enough to suggest that they are tapping a common dimension, presumably intolerance of ambiguity. It is clear that intolerance of ambiguity is intrinsically equivalent to an over simplified and thus reality-oriented approach characterized by the dominance of crude and unessential aspects.

In 1949 Cattell and Tiner carried out an experiment, administering 17 tests to 100 male college students. The first factor to be extracted from this battery is called "disposition rigidity" (perseveration). This identification does not appear too well justified, as a measure of high motor perseveration, which was the average of four tests of the creative effort type personality used. Cattell's second factor is one of spatial intelligence. The fundamental property common to all the phenomenon concerned has been phrased by Spearman in terms of general mental law of inertia which reads : "Cognitive processes always both begin and cease more gradually than their (apparatus) cause". This law summarises the varied experimental findings, which individual differences with respect to mental inertia are hypothesized to understand the various typologies.

On an examination of the phenomenon of intolerance of ambiguity it is seen that this is negatively correlated with intelligence. The first hypothesis of the present study is that intelligence is positively correlated with transfer and since intolerance of ambiguity is negatively correlated with intelligence hence it may be hypothesized that intolerance of ambiguity has a negative correlation with transfer, i.e., a high rank on the intermodality test is an indication that a person would rank low on the scale of intolerance of ambiguity.

(3) Rigidity. Rokeach (1960) defined rigidity as "the inability to change one's set when the objective conditions demand it, as the inability to restructure a field in which there are alternative solutions to a problem more efficiently". It was Rokeach's contention that the solution of a critical problem by the Einstellung method could be taken as "an indication of rigidity". But Luchin criticised it because einstellung solution of a critical problem could be the resultant of various kinds of thought processes and while under certain conditions it might be indicative of a mental set on einstellung, yet it may not be a valid indicator of rigidity. According to Frenkel-Brunswik rigidity and intolerance of ambiguity are the characteristics of an authoritarian personality.

It is in Freud's work that we find one of the first systematic treatment of certain phases of the rigidity flexibility question. He observed that there were persons who showed exaggerated behaviour trends that focussed about unusual frugality, obstinacy and orderliness.

Systematic interest in the rigidity looseness at a rather simple level is evident in much of the literature concerned with the phenomenon of perseveration. It had been observed in psychological laboratories that when individuals were asked to perform some simple task and then required to do similar but different task, there was tendency for response

associated with the first task to persist or perseverate so that the interfered with the response to the second task. Pinard, Stephenson and Cattell and others worked batteries of simple perceptual and motor tasks that demanded shifts in activity and measured a perseveration factor relatively independent of intelligence. Low and sometimes high correlations were found between perseveration scores and various measures related to personality.

Kurt Goldstein (1943) (1942) emphasis that rigidity is a normal phenomenon that simple becomes exaggerated in organic pathology. He distinguishes 2 types of rigidity - a primary rigidity due to the fact that a stimulus may arouse some response system so strongly that the individual becomes incapable of shifting in response to new stimuli and a secondary rigidity in that manifests itself only when the individual finds himself faced with a task with which he cannot cope. Lewin and Kounin (1940) (1941) have been concerned with rigidity in the feeble minded. Recently there has been growing interest in the Goetie rigidity concept among clinical workers. The paranoid shows greater rigidity in his perceptors of very simple stimuli. A further branching off in the application of the rigidity concept may be seen in a project by McAndrew. The general results indicated that isolation caused physical handicaps which leads to increased or unusual rigidity.

Experimented validation regarding rigidity was furnished by the findings of Luchin and Rokeach. Rokeach investigated a problem of rigidity related to ambiguity. He used a gestalt psychological thinking problem involving manipulation of three jars. Rigidity was measured by having subject solve problems in which required qualities of water were obtained by manipulating three jars of given capacity. The results presented by Rokeach indicate clearly that the children scoring extremely high on ethnic prejudice solve the new problems more rigidly than those extremely low or prejudice. Correctness of thinking was measured by the use of scratch pater in solving the problem. The concrete attitude is one of being bound to the immediate experience of the given thing or situation in its uniqueness. Escape into the concrete represents dealing with tangibles and certainties, where everything opaque and complex can be avoided. Those high on prejudice were found to use more scratch paper than those low in prejudice. Significant correlations were obtained between rigidity scores gained by Rokeach and the total score on the personality inventory which had been designed to measure dichotomizing the emotional and social attitudes.

Luchin (1945) used einstellung experiment as a test for rigidity. According to Luchin the degree or rigidity displayed by an individual was found to be not a constant but a variable

depending on such factors as the particular test material employed, the subjects attitude towards and interpretation of the task and relationship between the subject and the tester. In other words, Luchins studies indicate that rigidity is not a function of the personality but of particular field conditions. Kounin had also pointed out that rigidity in behaviour may be due to any number of factors other than rigidity in personality structure.

Rigidity and chaos are closely related on theoretical and empirical grounds. Goldstein has pointed out the existence of rigid and disintegrated behaviour in the same individual. Frenkel-Brunswik found in the rigid children, artificial isolation and separation of feelings and attitudes which belong together and at the same fusion of attitudes which do not belong together.

Werner (1940) conceived of rigidity as being caused by either too much isolation of the different subareas of personality or by too much overlapping in the sense of perseveration of certain elements throughout the entire mental life. Both the isolation and keeping apart of sets as well as the tendency toward undue perseveration of the same set can serve the function of evidence of complexities. The splitting and exclusion from consciousness of unacceptable tendencies such as aggression against authority fear or weakness may be

considered as contributing to lack of insight, the rigidity of the narrowness of the ego, characteristic of those intolerant of ambiguity.

The concept of rigidity and intolerance of ambiguity are theoretically and historically related, indeed in fact so closely related that at times the two concepts have been treated as approximately equivalent. Eysenck treated them as equivalent, Werner points out the confusion of the term 'rigidity'. Some confuse it with the term differentiation. Some assume that rigidity is a uniform rather than multiform trait. Varieties of meanings are attached to rigidity. Rigidity has been variously defined as the fixation of response, lack of variability, perseveration, inflexibility, stereotype, einstellung and degree of permeability of boundaries. The construct of rigidity used by Jacob Kounin refers to a postulated property of personality structure that has its place in a series of inter-related statements and constructs in typological and vector psychology. The person is said to be structured and differentiated into parts. The unit of structure is called a region. The construct of rigidity deals with the neighbouring regions of the person. In the words of Kounin 'Rigidity is that property of a functional boundary which prevents communication between neighbouring regions. The degree of communication of a region A with the region B, or vice

versa. Regions A and B are in communication to the degree to which a change of the state of A changes the state of B. Werner criticises that it has a 'literal' viz., "physical meaning", that it is structuralised rather than functional, that the "usefulness of this new definition appears to be doubtful", and that, "it does not take into account sufficiently the functional dynamics underlying behaviour". Kounin agrees with theories that rigidity increases with age.

The difference between intolerance of ambiguity and rigidity is that intolerance of ambiguity is situational. For it an ambiguous situation is essential. For rigidity a situation may be ambiguous or not. Rigidity is characteristic of the person who is intolerant of ambiguity. A rigid person is not necessarily always intolerant of ambiguity. The concept of intolerance of ambiguity is variable. It varies from one person to another and in the same person from time to time.

More importance is attached to the significance of rigidity and increased effort is made to relate rigidity to a wider range of variables. Rigidity is measured by Lewinian group in more complex terms as evaluation of the subjects' response to tachistoscopically presented stimuli, subjects' reaction to ink blots, subjects' ability to shift categorisation of objects and ideas and subjects' manner of handling and integrating various kinds of play material.

The rigidity of persons of low intelligence is generally greater than the rigidity of a person of high intelligence. Persons with organic brain pathology, neurotic and schizophenic are more rigid. Persons isolated from the world due to physical handicaps are also more rigid than normals. When different kinds of rigidity measures are applied to the same group there may be a real difference in the result.

It is thus seen that rigidity and intolerance of ambiguity are approximately equivalents (Eysenck 1954). An attempt is made in this study to correlate both these variables to intermodal transfer. Since intolerance of ambiguity has been hypothesized to correlate negatively to transfer and since rigidity and intolerance of ambiguity are almost equivalents, hence it can be presumed that rigidity also would have a negative correlation with transfer, i.e., the more rigid the person the lower will be the score on the transfer test.

(4) <u>Introversion-extroversion</u>. The discussion on this bipolar factor may best be opened by a quotation. Jung believes that "medical experience has taught us that there are two groups of functional nervous disorders - the one embraces all those forms of disease which are designated hysteria, the other all those forms which the French school has designated psychasthenia; the hysteria belongs to the type of extroversion, the psychasthenia to the type of introversion.

Eysenck (1947) described extroversion-introversion

as a type of concept with the "highest level of generality". He connects the concept with Hull's law of reactive inhibition (1943) in a formulation linking personality theory with learning theory. Individuals in whom reactive inhibition is generated quickly and strongly and dissipated slowly, are thereby predisposed to develop extroverted patterns of behaviour, and hysterico-psychopathic disorders in neurotic breakdown, conversely individuals in whom it is generated slowly and weakly, and dissipated quickly, are thereby predisposed to develop introverted patterns of behaviour, and dysthmic disorders in case of breakdown.

One great difficulty immediately threatens to make any identification between hysteric tendency and extroversion and dysthyma and introversion, quite impossible. This difficulty lies in the fact that American investigators using a variety of questionnaires measure essentially have shown conclusively that questionnaires of introversion measure essentially the same personality qualities as questionnaire of "neuroticism" (Bernreuter 1934). Factorial studies of these questionnaires usually reveal a general factor which as Vernon points out, "does in part correspond to a genuine maladjusted-psychoneurotic - introverted tendency" (1938).

In a study by Collier and French (1938), it is shown that most questionnaire constructors have used Freud's

concepts of "introversion" with incipient neuroticism. He writes, "An introvert is not yet a neurotic, but he finds himself in a labile condition, he must develop symptoms at the next dislocation of forces, if he does not find other outlets for the pent up libido" (1920). Jung on the other hand considers that "it is a mistake to believe that introversion is more or less the same as neurosis. As concepts, the two have not the slightest connection with each other" (1923).

Another difficulty appears to be due to faulty understanding of Jung's point of view. Tests of introversion usually contain a large number of questions regarding sociability. In fact extroversion and sociability are completely identified in the minds of many writers. Close study of Jung's writings discloses that "sociability" is not one of the outstanding marks of the extrovert, the view that there is a close connection between the two appears due to Freyal (1924) who maintained that the extrovert is "an individual in whom exists a domination of the thought processes the relation to directly observable social behaviour with an accompanying tendency to make social contacts". This view does not fit in too well with descriptions of the hysteric as given by clinical observers. Thus Henderson and Gillespie (1943) for instance, show that "the personality in hysteria

is frequently an unusual one, apart from the tendency to dissociation. The hysterical patient is often emotional, shy and reserved, even a little "peculiar". There has been described an "hysterical personality". This consists of lifelong threatricality of behaviour and a desire to impress and gain sympathy, a contrast between actual shallowness of the feelings and the intensity of the expression of them, a contrary contrast of external shyness and intense erotic interest, a lack of persistance of emotion and of effort, and much compensatory day dreaming." This quotation which represents the hysteric as "shy and reserved" must throw grave doubt on the propriety of using sociability as the main criterion of extroversion, as is done by most questionnaire makers of recent years, and therefore, lack of "sociability" must be regarded as an index of neuroticism and not as a sign of introversion (Eysenck 1966).

Putting the results of Eysenck into a descriptive paragraph we find that (neurotic) introverts show a tendency to develop anxiety and depression symptoms, that they are characterised by obsessional tendencies, irritability, apathy and that they suffer from a lability of the autonomic systems. According to their own statements their feelings are easily hurt, they are self conscious, nervous, given to feelings of inferiority, moody, day dream easily, keep in the background

on social occasions, and suffer from sleeplessness. In their body build vertical growth predominates horizontal growth, their effort response is poor and their cholinesterase activity is high. Salivary solution is inhibited. Their intelligence is comparatively high, their vocabulary excellent and they tend to be persistent. They are generally accurate but slow, they excel at finicking work (Tweezers tests). Their level of aspiration is unduly high, but they tend to underrate their own performance. Withal they are rather rigid and show little intraporsonal variability. Their aesthetic preferences are towards the quiet, old fashioned type of picture. In aesthetic creation they produce compact designs often having a concrete subject. They do not appreciate jokes very much and sex jokes in particular are not much favoured. Their handwriting is distinctive.

In comparison (neurotic) extroverts show a tendency to develop hysterical conversion symptoms, and a hysterical attitude to their symptoms. Furthermore, they show little energy, narrow interests, have a bad work history, and are hypochondriacal. According to their own statement they are troubled by stammer and stutter, are accident prone, frequently off work through illness, disgruntled, and troubled by aches and pains. In their body build horizontal growth predominates over vertical growth, their effort response is quite good and

their cholinesterase activity low. Salivary secretion is not inhibited. Their intelligence is comparatively low, their vocabulary poor, and they show extreme lack of persistence. They tend to be quick but inaccurate. They are bad at finicking work (Tweezers test). Their level of aspiration is low, but they tend to overrate their own performance. They are not very rigid and show great intrapersonal variability. Their aesthetic preferences are towards the colourful modern type of picture. In aesthetic creation, they produce scattered designs, often having abstract subjects. They appreciate jokes, and are particularly fond of sex jokes. Their handwriting is not distinctive.

In contrasting these two descriptions one is reminded of the Freudian trilogy - id, ego and superego. In the conflict between id and superego, it would appear that in the extrovert (hysteric) the id had achieved a superior position, while in the introvert (dysthmic) the superego had gained the upper hand. While it is quite possible that this comparison is nothing more than a picturesque but inaccurate analogy, it may be worthwhile to point out briefly on what basis such an analogy could be drawn.

In the first place, the attitude to work is obviously different for these two types. The hysteric has a bad work history, a low level of aspiration, is apt to

overrate his performance, is slapdash (quick but inaccurate) and lacks resistance. The dysthmic has a good work history, a high level of aspiration, is apt to underrate the performance, is thorough (slow but accurate) and very persistent. Now the qualities which characterise the dysthmic are precisely the "socialised" qualities which one would expect to be favoured by the superego, while the qualities which characterise the hysteric are the immediate pleasure producing qualities which in Freud's teaching are associated with the id.

In the second place, greater structural rigidity is usually associated with superego dominance, and such rigidity is found both in the reactions of dysthmics to success and failure experiences, as also in their tendency to produce compact designs in the mosaic test. On the other hand, the hysterics show less rigidity, and favour scattered designs.

In the third place, the attitude of hysterics and dysthmics to sex jokes is highly revealing. In terms of the Freudian theory, the id would be expected to rate this type of human very high while the superego would be expected to repress vigorously the enjoyment of this type of material.

Whatever may be though of this interpretation, it seems fairly clear that the dysthmic represents the more socialised, inhibited type of neurotic, while the hysteric appears as a more asocial, uninhibited typed.

The work done by Eysenck reveals that extroverted individuals possess a lower level of intelligence than introverts. It has also been shown that introverts have more rigidity than extroverts. Thus it can be presumed that introversion would be positively related to transfer facility, i.e., a high score on transfer test would be an indication of introversion, as it is an indication of intelligence.

(5) Kinaesthetic Figural After-Effect (KFAE). For half a century since Sherrington (1906), the eyes, ears, nose and mouth and skin have been classified as exteroceptors; the end organs in muscles, joints and the inner ear have been called interceptors. It seemed very plausible that three types of sensation should correspond to these three types of receptors (a) sensations of external organ; (b) sensations of movement and (c) vague sensations of the internal organs. These were considered respectively the basis for (a) perception, (b) Kinaesthesis or the awareness of movement and (c) feeling and emotion.

Kinaesthesis literally denotes the pickup of movement. But it refers exclusively the body movement, not movement of anything in the world. This is almost the same thing as proprioception. The discrimination of body movement from non movement is too important for the organism for it to have been

wholly entrusted to any simple group of receptors. There are many kinds of movement that need to be registered. There is articular kinesthesis for the body framework, vestibular kinesthesis for the movement of skull, cutaneous kinesthesis for movements of the skin relative to what it touches and visual kinesthesis for perspective transformation of the field of view. In all these perceptions the sensory quality arising from the receptor type is difficult to detect, but the information is perfectly clear. Kinesthesis is a registering of such information without being sensory, it is one of the best examples of detection without a special modality of sensation.

The history of kinesthesis is recounted by Boring (1942). The misunderstanding about a muscle sense only contributed to the confusion. The arguments of Charles Bell, who conceived it in 1826, should probably be interpreted in terms of what is now known as re-entrant or re-afferent input, or feedback, not in terms of a separate department of sense. The cooperation of the supposedly separate senses of touch and kinesthesis is an old and controversial problem in psychology (Boring 1942).

Figural after effect, satiation and reactive inhibition are closely related concepts. When prolonged exposure of a figure to a perceiver produces distortion or displacement in the phenomenal characteristics of another

figure, the phenomenon is referred to as figural after effect. The general procedure for obtaining this phenomenon is simple. One figure (Inspection figure or I-figure) is observed for a set period with constant fixation. Then a second figure (test on T-figure) is observed and its phenomenal characteristics reported immediately.

A large number of studies have been made on KFAE. The important study was done by R. Allen Gruduer (1961). "Immediate and Residential FAE - in kinesthesis". Similar studies have been reported by Charles Costello (1961). "Consistent Errors in the Measurement of KFAE", Joseph J. Moylon (1964) "Kinesthetic Figural After Effects were satiatio or contrast", Bourne and Beier (1961) "Effect of duration of Inspection upon KFAE".

In 1961 another interesting experiment was reported by DE Broadbent. He tried to pin down the differences that occur in KFAE to individual differences. For this he took 3 groups of normal males. Doubt was expressed at Eysenckts predicated positive correlation between extroversion and KFAE. He arrived at the conclusion that the manner of presentation of stimuli is crucial and that extroverts do not necessarily show longer figural after effects. A related study was done by Wareross, Katheyx F., Lipnon Ronalds and Spitz on the

relationship of extroversion - introversion to visual and kinesthetic after effects, in which they concluded that their results confirm the previously reported study of Recht and Schaffer (1953) but fail to confirm Eysenck's hypothesis (1966) that satiation effects in extroverts developed at a faster speed, reach high levels and dissipate rather slowly as compared to introverts.

"Figural After Effects, Intermodality Correlation and Personality" was the subject matter of research by S.K. Paul (1964). Techniques used were similar to those of Christman, Eysenck, McEwen and others to produce auditory, kinesthetic and visual figural effects. Measures of these effects were then correlated with extroversion scores. All intercorrelations were found to be insignificant. Moreover, Eysenck's hypothesis that extroverts elicit stronger figural after effects is not supported by these results.

Another attempt to correlate KFAE to personality was made by Kool (1971). Correlations were found to be vague and inconsistent, and the results do not support Eysenck's theory of personality. Eysenck (1962) himself carried out a study to investigate "Figural after effects, Personality and Interocneory Comparisons". He failed to obtain any correlations between visual after effects and kinesthetic after effects, as well as correlations of either with personality.

Anderson's (1966) study, however, confirms Eysenck's view. In "An attempt at Relating Adaptive Visual After Effect Processes to Personality", he found that extroverts elicit stronger FAE.

There are more studies disproving Eysenck's hypothesis than those in favour of it. Broadbent (1961), Paul (1964), Kool (1971) have all failed to reach any conclusion testifying and proving Eysenck's reasoning.

In the present study also it was hypothesised that there would be a positive correlation between transfer and KFAE. Since higher score on transfer is an indication of an introverted tendency (Hypothesis 4) (which is in conformity with the work done by the above investigators), it may be presumed that extroverts do not exhibit larger KFAE. An individual showing high on a test of KFAE would obtain similar scores on a test of transfer also, as both involved the use of certain common sensory functions.

Secondary Hypothesis.

(6) Vision Versus Touch. Berkeley says, "If we take a close and accurate view of the matter it must be acknowledged that we never see and feel one and the same object. That which is seen is one thing, and that which is felt is another."

There have been conducted numerous studies on the modalities of vision and touch. To begin with Zinchinko (1960)

studied the "Functions of Hand and Eye Movements in the Process of Perception". Two kinds of motion can be distinguished in vision and in touch (a) searching and anticipatory and (b) Pursuit. Searching movements serve to orient the subject in the tactile and visual fields while pursuit movements facilitate such functions as "image-making, measurement, control and correction. Churchill (1960) made a crossmodal comparison using the tactual and visual modalities to judge the relative diameter of a series of rods. They were underestimated when presented tactually and overestimated when judged visually.

In 1964 Rock, Irvin, Victor and Jack tried to resolve the conflict between vision and touch. Their results reveal that vision is strongly dominant, often without the O's being aware of a conflict. Chang Tseng Hui and Tsao Thi-Chang (1964) concluded that recognition of forms is better when vision and touch are employed and utilised separately rather than jointly. Similar result was obtained by Lobb, Harold (1965) who conclude that vision is more effective in learning to discriminate forms unimodally. When discrimination required joint participation of the two modalities, sequence VT was superior to sequence TV.

Lederman, Susan and Taylor (1969) studied "Perception of Interpolated Position and Orientation By Vision

and Active Touch". They found that errors for touch are larger than those for vision.

Appelle Stuart (1971) and Fico, Jones, Brodsky and Howard's (1972) studies also indicate the superiority of visual information processing.

Garwill and Molander (1971) investigated cross modal transfer and studied verbal mediation effects. In stage I transfer appeared to be larger when training started tactually and was tested visually than vice-versa. This is the only study which has placed tactual modality on a higher level.

Although many studies have supported Rock and Victors conclusion (1964) that visual tactile conflict will be resolved in favour of vision, McDonnell's study (1972) presents evidence that methodological problems may have produced a bias in favour of vision. The results indicate that the generalisation of vision as a dominant modality may be premature.

A large number of studies, enumerated above, have pointed out the superiority of VT to TV. In the present study also it has been hypothesized that VT transfer would be easier than one in the reverse direction, i.e. TV.

The main hypothesis formulated for the present study may be summarised as follows :-

(1) There will be a positive correlation between intelligence and transfer.

(2) There will be a positive correlation between intolerance of ambiguity and transfer.

(3) Rigidity and transfer will also be positively correlated.

(4) There will be a positive correlation between transfer and introversion and a negative correlation between transfer and extroversion.

(5) KFAE and transfer scores will be positively correlated.

(6) A secondary hypothesis was Visual to tactual (VT) transfer will be easier than tactual to visual (TV).

CHAPTER IV

METHOD AND PROCEDURE

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The present investigation aimed at (1) studying the transfer of learning between vision and touch and (2) investigating the relationship of the phenomenon of intersensory transfer with that of personality variables. Intersensory transfer involved correct recognition of specific external stimulus material by the modality other than that originally involved in receiving the sensory informations from the stimulus. For example, if vision has been used in processing a particular object, then one will be required to use his tactual modality in order to recognise the same object. Correct recognition of the object would show that intersensory transfer has taken place. Intersensory transfer can be from visual to tactual (VT) or from tactual to visual (VT). The question posed was : which of the two modes of intersensory transfer is more effective ? The second question was. Is this phenomenon purely physiological or purely psychological or a combination of the two ? In other words what does facility or ease in transfer represent ?

The study was designed on the principles of simple experimentation and correlational methods as no experimental manipulations of a higher order were involved. The way in which the study has been conducted, the tests that have been

used, instructions given etc., are described at length here. The chapter has been divided into two sections : (1) Material and Procedure and (2) Sample.

(1) Material and Procedure:

In the present investigation the intermodality transfer was the independent variable and certain tests personality were dependent variables. For the measurement of intermodality transfer a test was developed by the author, (details of which are given in the following pages), and for the study of the dependent variables standardised tests developed by other investigators were used. First the intermodality transfer test is described and later on particulars of other tests used is given.

Following is the list of tests used in the present study :

(a) Intermodality transfer test - developed by the author.
(b) Verbal intelligence test - Jalota (1956).
(c) Bhatia's Performance Battery of Intelligence.
(d) Kool's Ambiguity Scale.
(e) Kool's Rigidity Scale.
(f) Eysenck's Personality Inventory.
(g) KPAT test.

Each of the above tests is described in the following pages.

(a) Intermodality Transfer Test: In previous work on form discriminations shows that the ability to differentiate between different forms is well developed in normal children by the age of 5, whether the stimuli are simple geometric figures (Birch and Lefford 1964), random polygons (Brown and Goldstein 1967) or Letters of Alphabet (Gibson, Osser, Schiff and Smith, 1964). The discrimination of identical forms in different orientation preferences, affecting accuracy of recognition in a matching form sample situation, in children upto 5 years old (Ghent 1960, Ghent & Bernstein 1961, Braine 1965). Stimulus alignment has been shown to influence responses in a regular fashion in children (Sebular and Rosenblith 1964, Muttenlocker 1967) and in adults (Secular and Houlihan 1968). Wohlhill and Werner (1964) also point out that latencies are longer for low directionality than for high directionality figures, which can be taken as indicating a greater degree of "effort" in some sense, being required when orientation is not clearly marked. Gibson (1964) reports a similar increase in latencies in the matching of highly confusable letters.

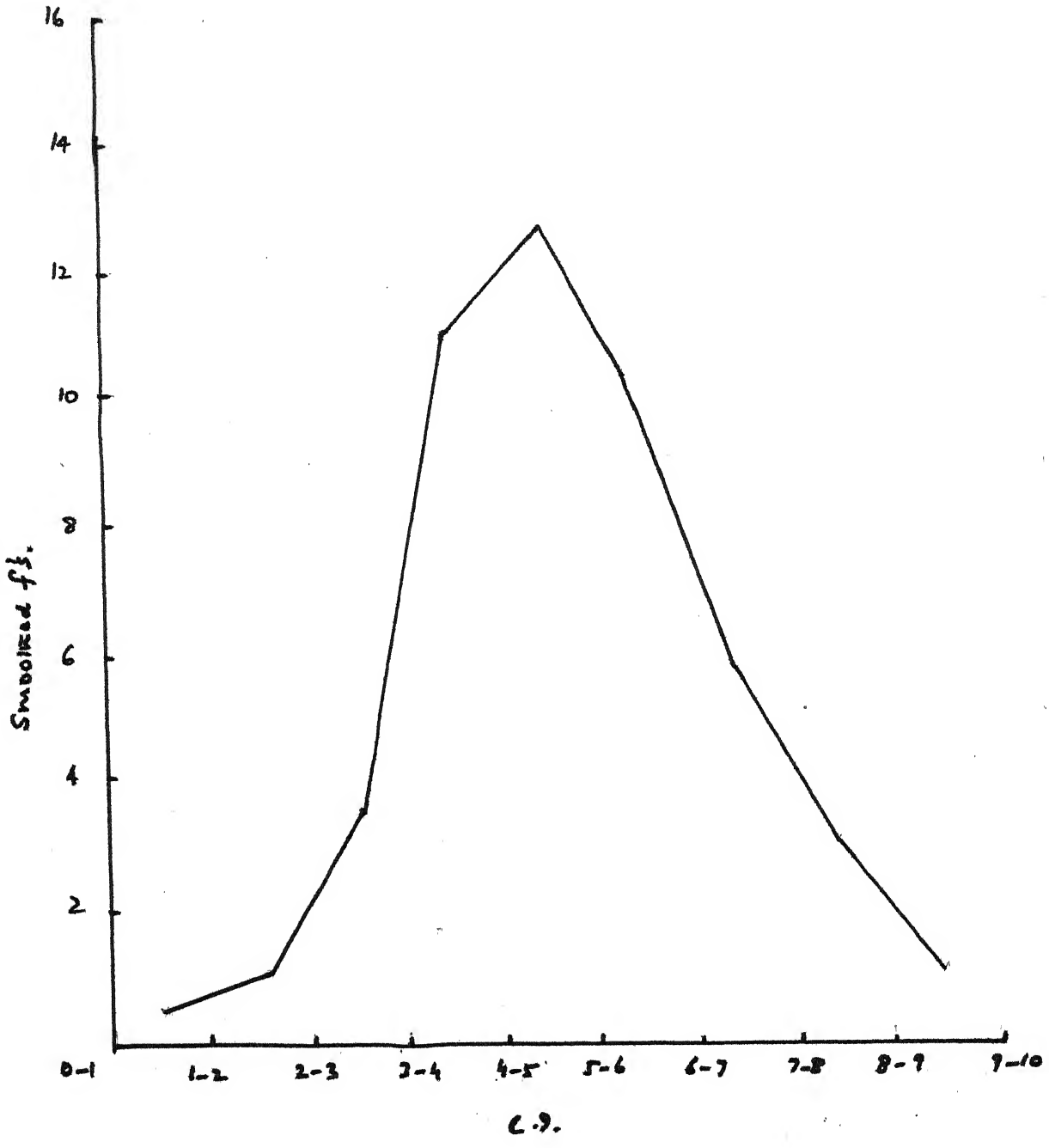
The well known series of papers by Eleanor Gibson and her colleagues (Gibson Gibson Pick & Osser, 1962; Gibson 1964; Gibson, 1965) presents a more detailed and larger scale

analysis of a particular aspect of the problem as it appears in the first stages learning to read : "..... what dimensions of difference must a child learn to discriminate for each letter to become unique ? (Gibson 1964). In the first paper cited they found that certain transformations of letter like forms were more likely to be confused with the standard form, and that the probability of obtaining correct responses with this type of material increased with age. There were two types of transformations which prescribed the original shape of the figure perspective, which essentially produced slight size changes, and rotation and reversal which affected orientation. There was little improvement in ability to discriminate the former in subjects upto the age of 8 while errors on the latter fell steadily to virtually zero by the same age.

However, none of these studies takes the subjects conception of 'similarity' into account. This is of some importance, since unless his interpretation of the usual form of institution, find a figure in this array which is "same as the standard" is known' it is not possible to decide if his errors are due to a genuine failure of discrimination or to his not possessing adult criteria of similarity. Garver (1966) has pointed out that discrimination is a process akin to classification, in which responses are determined more

GRAPH 3:1 DISTRIBUTION OF SCORES ON INTER MODALITY PHENOMENON

(N=25)



by the properties of sets of stimuli than those of individual members of the set.

The concern of this investigation was with the interaction of two aspects of functioning, the nature of the rules or principles of organisation available for classifying, and so imposing some order or structure on the world, and the way in which these are applied to the information that he extracts, in a more or less adequate manner, from the material presented to him.

(i) Selection of test items. Based on this rationale a test was constructed. In the initial stages of the study of intermodal transfer, items (various geometrical shapes) were made of plastercine. The number of items was only 10. The items varied in shape, size, height and later to the tactual for recognition and identification and again first to the tactual and then to visual for identification.

This method was adopted only to see whether the phenomenon of intersensory transfer exists. Data was collected on a small sample (N = 25). The distribution of scores (Graph 3.1) reveals that this phenomenon does exist and has almost a normal distribution.

Since it was not possible that data be collected

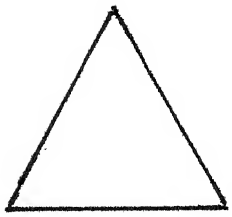
on a large sample with such stimulus material which is extremely malleable, it was decided that wooden pieces would be used. Hence the test was constructed in wood, and this was done in 4 series. The description of the series and the details of the stimuli are given below:-

The test comprised of 4 series -

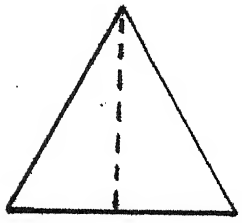
1.	Shape Series	-	Appendix A I
2.	Size Series	-	Appendix A II
3.	Height Series	-	Appendix A III
4.	Texture Series	-	Appendix A IV

I. Shape Series - included items which were different in shape, for example, triangle, square, rectangle etc. There were a total five subtests in this series. In each subtest there were 3 items, (wooden blanks) which differed in their shape. The details of each subtest is given as under :-

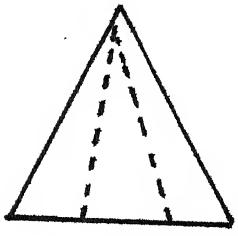
(i) (a) - A 3 sided figure with a height of 3½"



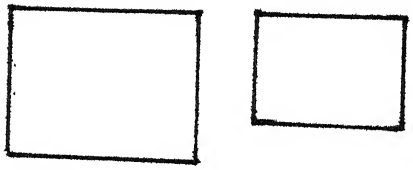
(b) - A four sided figure with a height of 3½"



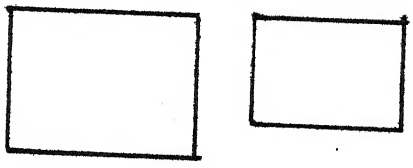
(c) - A five sided figure with a height of 3½"



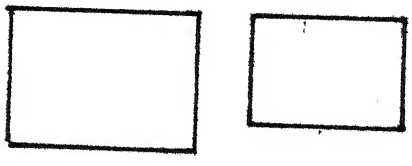
(ii) (a) - A four sided figure with a height of 2"



(b) - A four sided square with a height of 2"

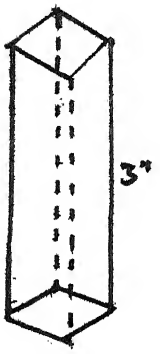


(c) - A Four sided rectangle with a height of 2"

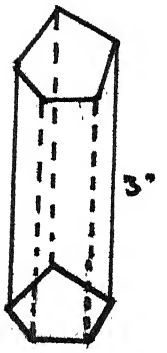


(iii) (a) - A cylindrical figure with a height of 3"

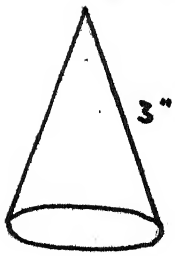
(b) - A four sided figure with a height of 3"



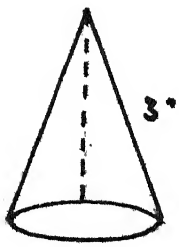
(c) - A five sided figure with a height of 3"



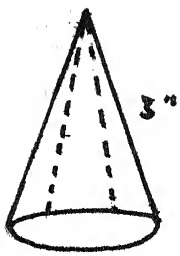
(iv) (a) - A round cylindrical figure with a height of 3"



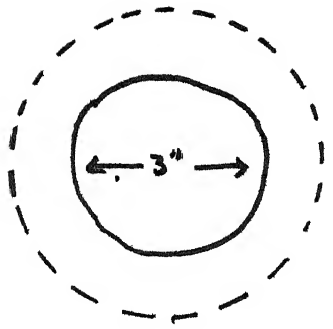
(b) - A four sided conical figure with a height of 3"



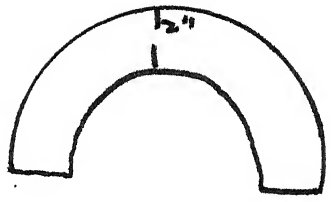
(c) - A five sided conical figure with a height of 3"



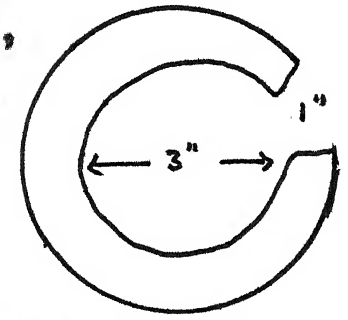
(v) (a) - A circular disc with a diameter of 3" and a thickness of 2"



(b) - A semicircular disc with a diameter of 3" and a thickness of 2"

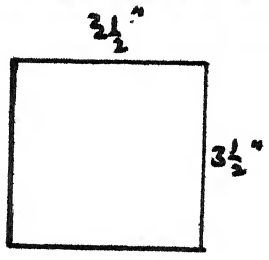


(c) - A disc with a diameter of 3", thickness of 2", but a small portion being cut off (1")

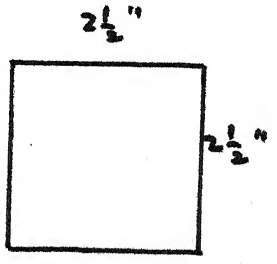


II. <u>Size Series</u> included items which had the same shape, same texture, but the size varied. In this series also each subtest had 3 items. The description is as follows.

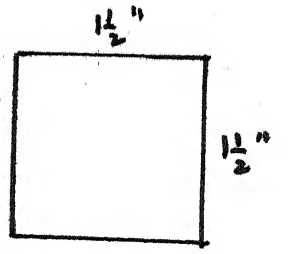
(i) (a) - A four sided square with a height of 3½"



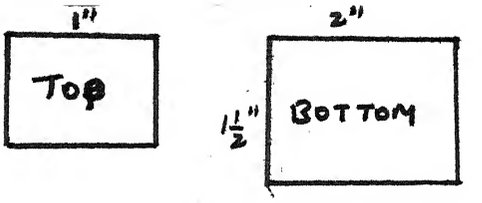
(b) - A four sided figure with a height of 2½"



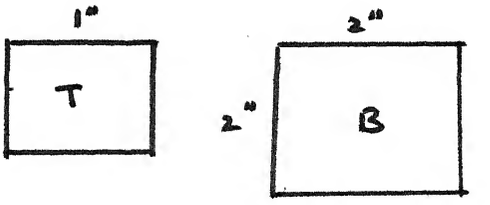
(c) - A four sided figure with a height of 1½"



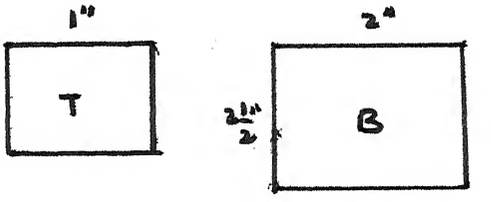
(ii) (a) - A four sided figure with a height of 1½"



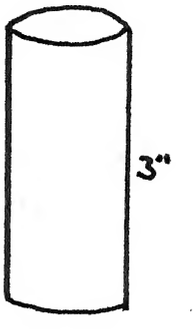
(b) - A four sided figure with a height of 2"



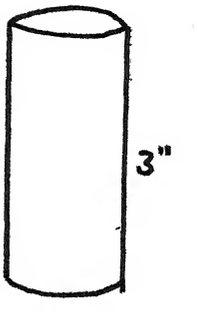
(c) - A four sided figure with a height of 2½"



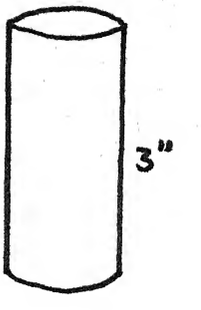
(iii) (a) - A round cylindrical figure with a thickness of 1", diameter 1½"



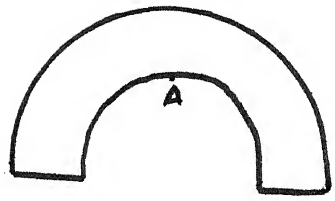
(b) - A round cylindrical figure with a thickness of 1½", diameter 2"



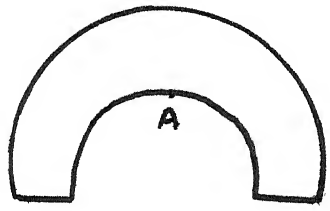
(c) - A round cylindrical figure with a thickness of 2", diameter 2½"



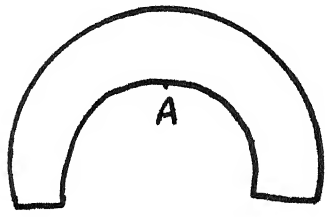
(iv) (a) - A horse shoe shaped figure. Height from A to base 2", width 1½"



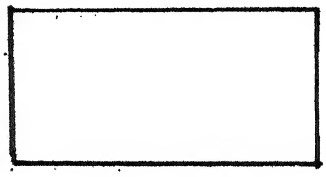
(b) - A horse shoe shaped figure. Height from A to base 3", width 1½"



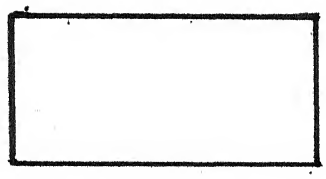
(c) - A horse shoe shaped figure. Height from A to base 4", width 1½".



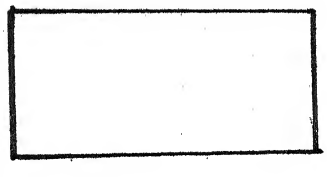
(v) (a) - A rectangular figure with a height of 1", width 2".



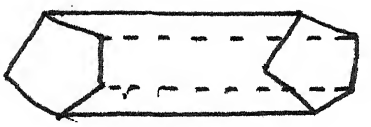
(b) - A rectangular figure with a height of 1½", width 3"



(c) - A rectangular figure with a height of 2", width 4".

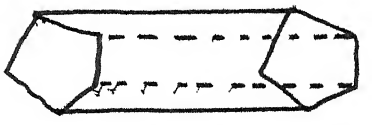


(i) (a) A five sided figure with a height of 5", each side having width of ¾"



(b) A five sided figure with a height of 4", each side ¾"

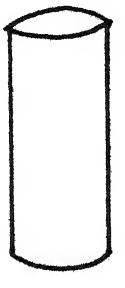
(c) A five sided figure with a height of 3", each side ¾".



III. Height Series - Consisted of 5 subtests, each subtest including 3 items. All items had the same shape, same size and same texture, only the height differed, for example, some were short while others were long.

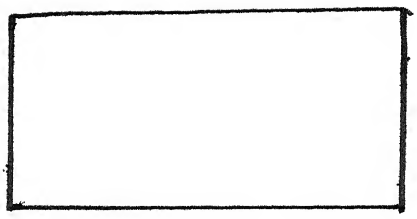
(ii) (a) Round cylindrical figure with a height of 3" and diameter 1½"

(b) Round cylindrical figure with a height of 4" and diameter 1½"

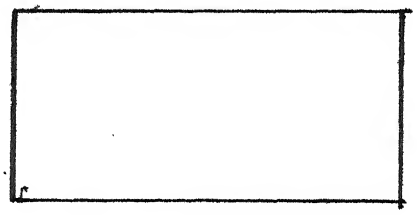


(c) Round cylindrical figure with a height of 5" and diameter 1½"

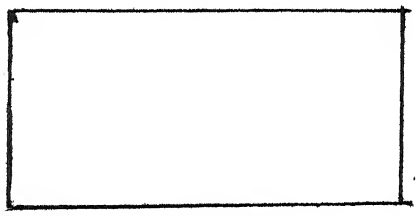
(iii) (a) A long rectangular figure with a height of 3" and width 1½"



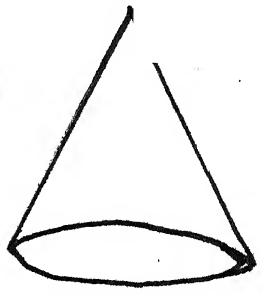
(b) A long rectangular figure with a height of 4" and width 1½"



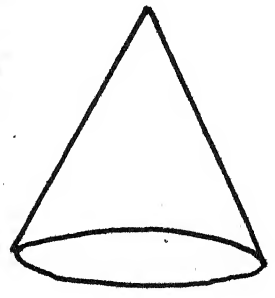
(c) A long rectangular figure with a height of 5" and width 1½"



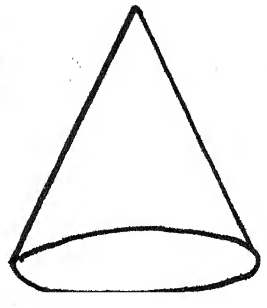
(iv) (a) A three sided conical figure with a height of 3" and diameter at the base 2½"



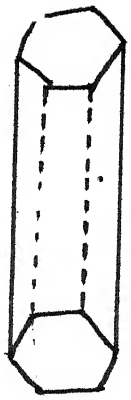
(b) A three sided conical figure with a height of 4" and diameter at the base 2½"



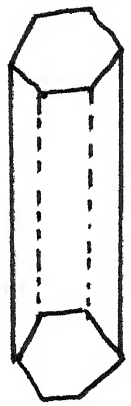
(c) A three sided conical figure xiyk with a height of 5" and diameter at the base 2½"



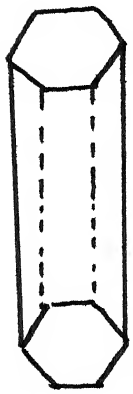
(v) (a) A six sided long figure with a height of 3" at the base, each side ½"



(b) A six sided long figure with a height or 4" at the base, each side ½"



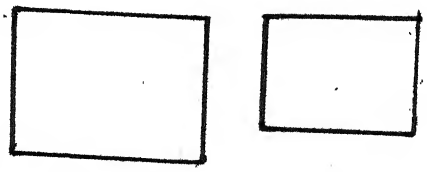
(c) A six sided long figure with a height of 5" at the base, each side ½"



IV. Texture Series included items having the same shape, size, and height but differed in their texture, e.g., some were rough and some were smooth. In this series also there were 5 subtests, each subtest comprising 3 items.

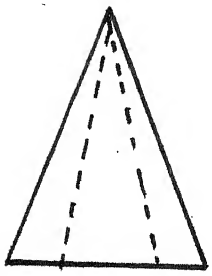
(i) (a) A four sided figure with a height of 2"

(b) and (c) Same as (a)

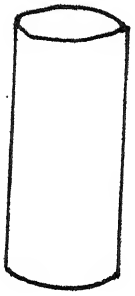


All the above pieces were of the same dimension, but differed in their texture. (a) was smooth, (c) was rough and (b) midway between (a) and (c).

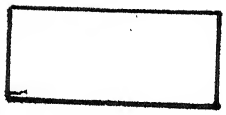
(ii) (a) A four sided conical figure with a height of 3½" at the base each side being 2½". As in (i) textures were the same.



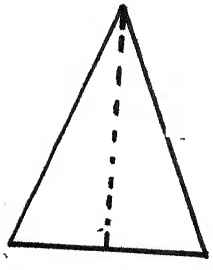
(iii) A round cylindrical figure with a height of 2", diameter being 2". Textures of (a), (b) and (c) were same as (i).



(iv) A rectangular shape with a height of 1" and 2½" long. Textures same as (i)



(v) A three sided conical figure with a height of 3" with a diameter of 2½". Textures same as (i).



(ii) Reliability. To find out the reliability of the test, it was administered on a sample of 40 students - 20 males and 20 females. All were undergraduates.

After a period of 25 days the test was conducted again and the Test Retest reliability computed. This interval was chosen to be a reasonable interval. For, if the test was repeated immediately, besides memory effects, practice and confidence induced by familiarity with the material would have affected the scores. The result would be to make for closer agreement between scores achieved on the 2 administrations of the test than would otherwise have been the case. Consequently the reliability coefficient would be inflated. On the other hand, if the interval between test and retest was too long, growth and learning experience would affect retest scores. Keeping this in mind on interval of 25 days was considered to be reasonable. The reliability coefficients are given in Table 3.2.

Table 3.2

Reliability Coefficients based on Test Retest Scores
N = 40

Method	VT	TV
Test retest	.49	.31
Split half	.72	.70

(iii) Item Analysis. The item validity of each item was determined with the help of point biserial correlation method (Garrett 1966). The computed values are given in Table 3.3. and Table 3.4.

Table 3.3

Correlational values of items with the total of the test

No. of subjects	Shape	Size	Height	Texture
1	.41	.43	.16	.45
2	.31	.37	.20	.43
3	.30	.32	.35	.28
4	.45	.24	.30	.39
5	.20	.44	.19	.40

Apart from the correlations of each item with the total of the series to which that subtest belonged were also computed. The values thus obtained are given below in Table 3.4.

Table 3.4

CORRELATIONAL VALUES OF ITEMS WITH TOTAL OF SERIES.

No. of subtest	Shape	Size	Height	Texture
1	.48	.48	.15	.61
2	.39	.37	.16	.56
3	.33	.46	.43	.25
4	.37	.17	.45	.39
5	.17	.37	.14	.30

Based on the values given in Table 3.4 only those subtests were selected for the final administration whose correlational value was .30 or above. Coming within this group were only 14 subtests - 4 each of shape size and texture series, and 2 of height series. Hence the final test comprised of 14 subtests.

(iv) Intercorrelations between the series. Since the coefficients of correlation were not very high, correlations of scores on each series were computed. The values are given in table 3.5.

Table 3.5

Correlations based on Test Retest Scores (N = 40)

	Shape	Size	Height	Texture
VT	.46	.27	.42	.81
TV	.30	.28	.35	.57

These values are also not very high and therefore intercorrelations between the scores on a particular series and the whole test were determined. Table 3.6 gives these values.

Table 3.6

Correlation of shape, size, height, texture series with the total of the test (N = 40)

	Shape	Size	Height	Texture
VT	.68	.30	.26	.93
TV	.45	.41	.54	.61

To determine the stability of the items, intercorrelations between the series was computed. These correlations were based on VT as well as TV scores. Table 3.7 and Table 3.8 show these intercorrelational values in VT and TV scores respectively.

Table 3.7

Intercorrelations between the series based on VT scores

	1	2	3	4
1. Shape				
2. Size	.337			
3. Height	.210	.340		
4. Texture	.391	.092	.39	

Table 3.8

Intercorrelations between the series based on TV scores

	1	2	3	4
1. Shape				
2. Size	.067			
3. Height	.46	.14		
4. Texture	.24	.104	.21	

(v) VT and TV. Correlation between VT and TV scores was found to be .525 (significant at .05 level).

(vi) Final reliability. Reliability coefficient was computed after item analysis. The method employed was split-half. The values obtained are given in Table 3.9.

Table 3.9

Reliability Coefficient on the Final Test

Method	VT	TV	Total
Split-half	.32	.79	.81

(vii) Scoring. There were 14 subtests in the final test. The two senses chosen for the study of intermodality transfer were vision and touch.

Each subtest was presented first to the visual sense and later to the tactual for identification. This, if done correctly, yielded one VT score. In this way all the other subtests yielded one score each. Thus the total score on VT series was 14.

Again, each subtest was presented first to the tactual sense and later to the visual for identification. This yielded a maximum of 14 TV scores.

(b) Jalota's Samohik Mansik Yogyata Parikshan (1964). This test in Hindi includes elements of vocabulary - similars, vocabulary - opposities, number series, classification, best answers, inference, analogies. In all there are 100 items. The reliability of the test was found to be .938 and validity ranged from .50 to .73. This test may be administered individually or in a group situation.

This test was used on a sample of 115 subjects. Later it was presumed that since the intermodality transfer test was in the nature of a performance test, a performance test of intelligence would correlate better than a verbal test. Hence a performance test (described below) was used.

(c) Bhatia's Battery of Performance Tests of Intelligence: Developed by C.M. Bhatia, it includes Koh's Block Design, Alexander's Pass along Test, Pattern Drawing Test, Immediate' Memory for Sounds - Direct and Reversed, Picture Construction Test. The validity of the test (found by correcting with the common criteria of school examination marks) was found to be of a high order.

(d) Kool's Ambiguity Scale: This scale has been developed by Kool. This was initially used by Coulter (1963). This scale has 14 statements. Each statement has to be carefully read by the subject and answered in any of the two predetermined categories of True and False.

Since this scale was in English it presented the same language difficulty as the California F-Scale had. Therefore, the Hindi version of this scale had to be prepared for being used with the sample. The scale was translated by a small group consisting of 5 experts - one each from the department of English, Hindi, Sociology, and two including the investigator from the department of Psychology. Every attempt was made by the team to use simple everyday language while translating the statements to be conveyed. The prepared Hindi version was then submitted to 5 judges independently. Each judge was requested to examine any ambiguity in the language of every statement and point out whether it conveyed the same sense which it was intended to convey in the original scale.

In the light of the various suggestions given by the 5 judges the statements were modified and the scale was cyclostyled for pretesting. The pretesting was done on 50 undergraduate students. Minor difficulties were experienced by subjects in 3 items. The required modifications were made by the investigation and the scale was again cyclostyled for determining its reliability and validity. Since the validity of the scale was to be determined by working out the correlation between the scores on the original Intolerance of Ambiguity Scale and the translated version of the scale of

the same subjects, special care was taken to use only those subjects who were proficient both in English and Hindi. Reliability was worked out by Test and Retest and split-half techniques. For determining the reliability and validity of the scale 50 subjects were used. Majority of them were either teachers, research scholars or senior students. At first, the Hindi version of the scale was administered to these subjects. After an interval of a fortnight Coulters original scale was administered to these subjects. The Hindi version of the scale was repeated 34 days after the first testing. This was done so that the interval between test retest may not be either too short or too long because both of them would hence have been undesirable for calculating the reliability of the scale. The split-half and test retest reliability coefficient for the Hindi version of the intolerance of Ambiguity Scale were worked out. The split-half reliability coefficient for the entire scale by using Spearman Brown Prophecy formula was .004 and the test retest reliability coefficient was .67. The test retest reliab. coeff. was significant beyond .01 level of confidence while the split-half reliability coefficient was insignificant. The significant value of the split half reliability was due to the fact that the division of the scale on the basis of the first half and the second half of the items was unsatisfactory. There was a particular kind of serialling of items due to

which an ambiguity division of the scale into 2 parts resulted in unequal halves. Since the 2 halves of the scale did not measure exactly the same thing, the value of the split half reliability coefficient was found to be low. This was further verified when the split half reliability coefficient of Coulters original scale of Intolerance of Ambiguity was worked out by similarly splitting the test into 2 halves. The obtained value was equally low.

The validity coefficient (with the original scale) for the Hindi version of the Intolerance of Ambiguity Scale came out to be .59 and was significant at .01 level of confidence.

Since these values were sufficiently high, the Hindi version of the scale was considered a reliable and valid measure. The original scoring system was retained, i.e., one score for each false response. The maximum score for the Intolerance of Ambiguity Scale was 14. The higher the score the greater the Intolerance of Ambiguity.

(e) Kool's Rigidity Scale: This scale was originally used by Coulter (1953). It consists of 22 statements and for each statement there are only fixed response categories of T and F. The subject is required to choose either one of them.

Since this scale was in English it was also translated into and adapted in Hindi. The same panel of experts and judges used in the case of Intolerance of Ambiguity Scale was also used in the present scale. Exactly similar procedure was followed for the preparation of the Hindi version of the Rigidity scale. Split half and test retest reliability coefficient of the adapted scale were .514 and .76 respectively while the corresponding value of the validity coefficient was .73. Since the obtained values were significant at .01 level of confidence the prepared test was taken to be a reliable and valid measure of rigidity.

Once score was assigned for each True response and zero for False response. The maximum possible score on R scale was 22. The higher the score, the more the rigidity in subject.

(f) <u>Eysenck's Personality Inventory</u>: This is a modified version of Mandsley Personality Inventory. This has 57 questions and measures two personality dimensions:

(1) Neuroticism (includes introversion)

(2) Extroversion.

E.P.I. measures the following factors:-

Mood-wings, Sociability, Jocularity, Impulsiveness, Inferiority feelings, Liveliness, Sleeplessness, Nervousness, Irritability, Sensitivity and Acquiescence.

Out of the 57 items, 24 deal with extroversion and 24 with neuroticism. The rest are lie scores.

(g) Kinesthestic Figural After Effect: Four T-blocks of wood, 2 plain and 2 graduated were used. Each T-block was mounted on a flat wooden stand, thus forming an inverted T-shape. Two plain T-blocks were one foot in length and widths of 1" and 1½" were needed as inspection T-blocks. The other 2 experimental T-blocks were graduated in width from top to bottom. The one which was used for the experimental conditions was 2" in width at the bottom, and .25" at the top. Each width interval was 1" in height and there were the following intervals:
.25", .375", .50", .625", .75", .875", 1.0", 1.125", 1.250", 1.375", 1.50", 1.625", 1.750", 1.875", 2.0".

Procedure

All the tests above mentioned required a period of 3½ hours. To avoid the effects of fatigue and non-cooperation on the part of the subjects, the study was conducted in four sessions.

In the first session those tests were administered which could be done so in a group situation. These were Jalota's Verbal Intelligence Test, Kool's Ambiguity Scale, Kool's Rigidity Scale, and Eysenck's Personality Inventory.

The forms of all these tests were distributed to the subjects in a group situation. The standard instructions read out and all doubts cleared. When the forms were completed they were taken from the subjects.

In the second session the Intermodality Transfer Test was conducted. The instructions for this test (given individually) were as follows :-

Instructions: This is an experiment to test whether what we see and feel are one and the same thing. You will be shown the geometrical shape for a limited time. You will then be blind-folded and the object which you have seen will be mixed with 2 other geometrical shapes. These three objects will then be placed one by one in front of you and you are required to identify the object that you have seen by just touching and feeling the objects one by one. The time for feeling will also be limited. If you identify correctly you will be given a score of one and if you fail to do so you will get zero. After each test you will be told the score.

In the second part of the experiment you will be blind-folded and an object will be placed in front of you. You will be allowed to touch and feel it for a given time. After that, as before, that object will be mixed with 2 other objects and will be placed one by one in front of you. Your eyes will then be opened and you will have to identify

(without touching the objects) the object you had touched earlier. Your cooperation in this experiment is greatly appreciated.

Instructions were given in English and Hindi, depending upon the knowledge and understanding of a subject. After giving the instructions in full, the following procedure was followed. Each subtest was presented first to the visual sense (Test). After a period of 10 seconds, the block was removed, and the subject was asked to close his/her eyes. Then the stimulus block was mixed with the other 2 blocks of that subtest and placed one by one before the subject. The subject had to identify, correctly or incorrectly, without seeing the blocks and just by tactual cues, the blocks he had seen earlier. In this way all the 14 subtestswere administered.

Later on, after a rest pause of 5 minutes, each subtest was presented to the tactual sense (for 10 seconds) and when mixed with other 2 blocks, it was presented to the visual sense for recognition or identification. All 14 subtests underwent the same procedure.

While conducting the test the precautions that were taken were : subject was permitted to use both his hands; he could lift the object stimulus with his hand (as

weight was not a variable used), the order of the presentation of subtests was random and it was predetermined; again, in each subtest, the order of the presentation of the standard stimulus and the buffer items was also predetermined, all stimuli were placed on the table; the presentation of blocks was successive and not simultaneous; time for exposure both for Test and Recognition was limited to a period of 10 seconds.

In the third session Bhatia's Battery of Performance Test of Intelligence was conducted. This test has 5 subjects. The instructions, procedure and scoring were performed in the same way as given in the manual.

In the fourth and last session, KFAE test was administered. Owing to strikes in educational institutions, only 50 out of the 115 subjects were available. Each subject was tested individually after necessary instructions and demonstrations had been given. After blindfolding the subject was asked to make an estimate of the width of the plain (inspection) T-block by touching the edges with the help of his thumb and index finger. Then he was given the graduated T-block and asked to judge the width which seemed equal to the width of the inspection T-block, after trying out the various widths on the block. The procedure was repeated for 6 trials with the right hand and 6 by the left

to arrive at a standard judgement soon. Since there were 2 T-blocks of 1" and 1½" widths respectively, the same procedure was followed.

(2) Sample.

The sample consisted of 115 subjects.

All subjects were undergraduate students.

Out of a total of 115 subjects, 58 were females and 57 males.

The age range of the subjects was 22 - 18, the average being 20 years.

All subjects were non-psychology students, and the sample was drawn from the Allahabad University and local degree colleges.

CHAPTER V

ANALYSIS OF RESULTS

CHAPTER V

ANALYSIS OF RESULTS

The purpose of the present study was to investigate the relationships between intermodality transfer and certain personality variables mentioned in the previous chapter. This study endeavours to throw light on the related problems of the degree of accuracy with which observers can render judgments as to form, or shape of certain geometrical figures applied tactually with vision excluded, and vice versa, and the psychological processes involved in the perception and correct identification of tactual and visual form, and, in particular, the more salient characteristics of personality which are helpful in this regard.

It was hypothesised that greater ease or facility in transfer phenomenon would represent a personality which is less rigid, less intolerant of ambiguity, introverted, with a higher level of intelligence, and, one capable of exhibiting greater kinesthetic figural after effect. These hypotheses were tested in the present investigation.

The results obtained and the main findings of the study are presented in this chapter.

The statistical measures employed for analysing the data were mean, median, SD, χ^2, product moment coefficient correlation and correlation matrices. Graphical methods included smoothed

frequency polygons and percentage curves.

The analysis of the data has been presented in three sections. Section I gives the distribution of scores on various series of intermodality transfer test and presents data relevant in bringing out VT and TV differences. Section II deals with the relationships between intermodality transfer and KFAB, and in Section III is presented the relationship between intersensory transfer and certain personality variables.

Section I

In this section the distribution of scores on the shape, size, height and texture series is given. Graphs 4.1, 4.2, 4.3, 4,4 and 4.5 exhibit the distribution of these scores, on shape, size, height, texture series and overall respectively.

Table 4.1

Mean Scores on Shape Series (N = 115)

Transfer	Boys (N=57) Mean	SD	Girls (N=58) Mean	SD
VT	2.33	1.30	2.34	1.46
TV	1.36	0.98	2.46	1.33

VT & TV :- t = 1.61

Scores Boys & Girls :- t = 1.46

Table 4.1 shows the means of boys and girls on the shape series of the intermodality transfer test. The analysis has been done sexwise (boys and girls) and also condition wise (VT and TV). The table shows that VT transfer is slightly higher than TV but the difference is not statistically significant (t = 1.51). The sex difference is also not statistically significant (t = 1.45)

Table 4.2

Mean Scores on Size Series (N = 115)

Transfer	Boys (N=57 Mean	SD	Girls (N=58) Mean	SD
VT	2.23	1.22	2.27	1.23
TV	1.32	0.91	2.03	1.01

VT & TV:- t = 1.03

Boys and girls:- t = 1.49

Table 4.2 shows the mean scores on size series of the intermodality transfer test. The mean scores on the two conditions VT and TV reveal that VT has higher scores than TV though mean difference is statistically not significant (t = 1.03). Similarly sex was not an apparent factor affecting transfer (t =1.49)

Table 4.3

Mean Scores on Height Series (N = 115)

Transfer	Boys (N=57) Mean	SD	Girls (N=53) Mean	SD
VT	1.30	0.79	1.22	0.67
TV	0.94	0.21	0.36	0.17

VT & TV:- t = 1.61

Boys and girls:- t = 1.30

Table 4.3 gives the mean scores on height series of the inter-modality transfer test. Here also the VT transfer mean is higher than its corresponding mean on TV transfer though the difference remained statistically not significant (t = 1.61). Similarly, sex was not found to be operating as a significant factor (t=1.30)

Table 4.4

Mean Scores on Texture Series (N = 115)

Transfer	Boys (N=57) Mean	SD	Girls (N=53) Mean	SD
VT	2.49	1.37	2.84	1.46
TV	1.89	0.99	2.33	1.30

VT & TV:- t = 1.67

Girls & Boys:- t = 1.48

The mean scores obtained on Texture series of the intermodality transfer test are given in table 4.4. The table shows that the mean scores on this particular series are the highest among all the series. VT mean is higher than its corresponding TV mean but the difference remains statistically not significant (t=1.67). The analysis done sexwise did not reveal any sex difference (t = 1.48).

Table 4.5

Overall mean scores on the Inter Modality Transfer Test (N = 115)

Transfer	Boys (N=57)		Girls (N=58)	
	Mean	SD	Mean	SD
Overall VT	8.35	4.06	9.19	5.19
Overall TV	6.56	3.43	6.87	2.61

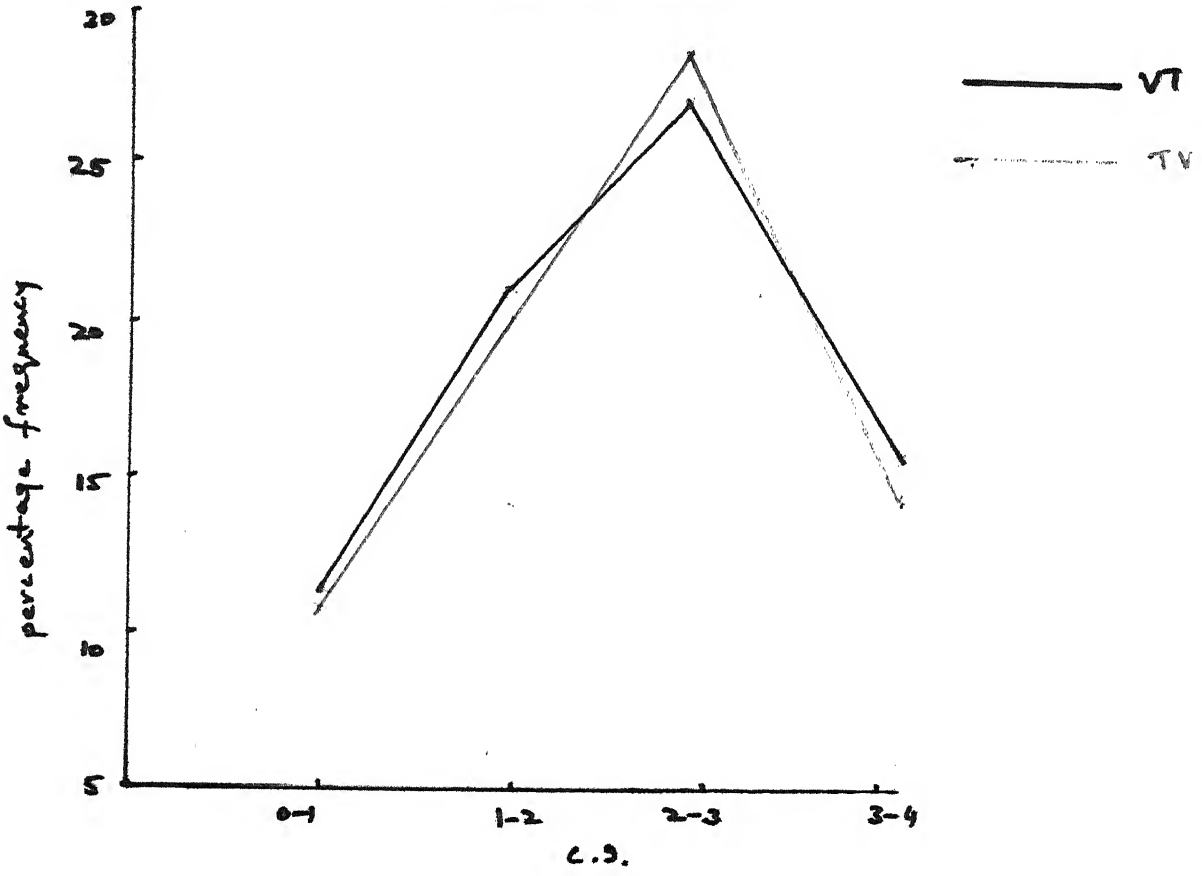
VT & TV:- t = 2.33

Girls & Boys :- t = 1.27

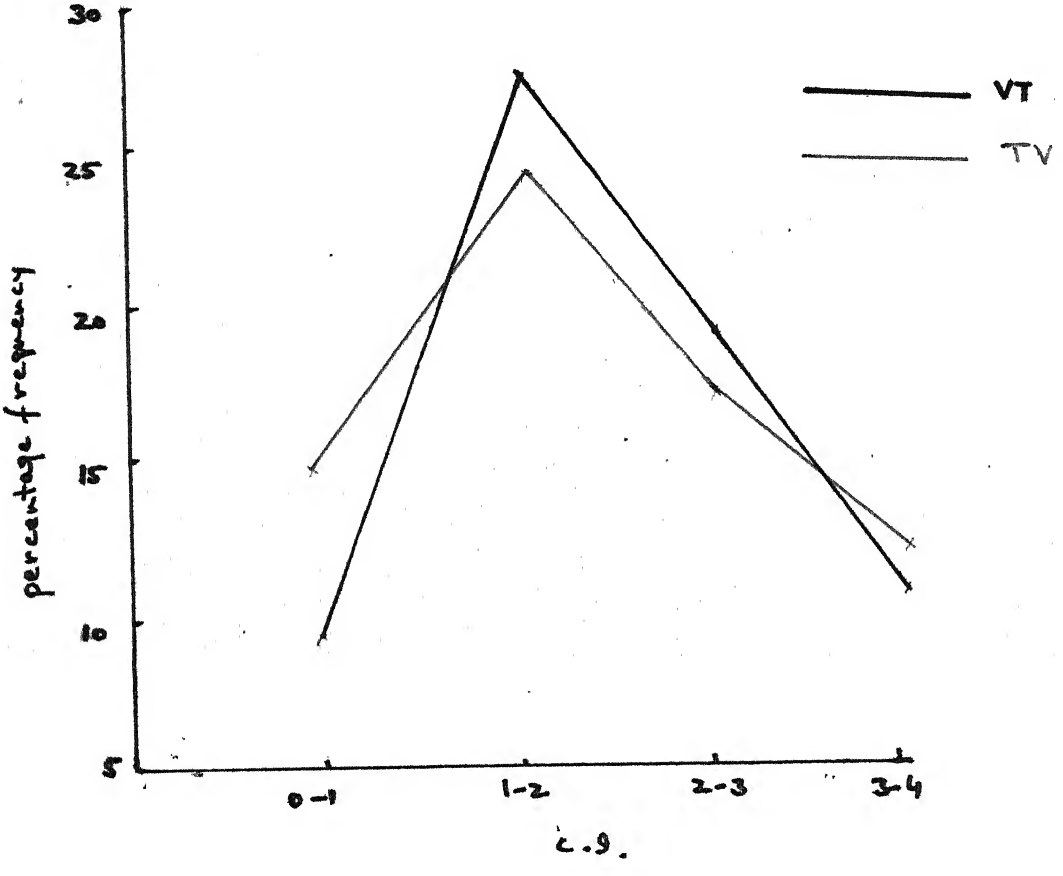
Table 4.5 gives the overall mean scores on all the series combined. When pooled the VT and TV differences were found statistically significant (t = 2.38). While the conditions (VT and TV) revealed a significant difference, sex was not found to be a significant factor affecting transfer (t = 1.27)

From the results presented in Section I, the following conclusions may be drawn:

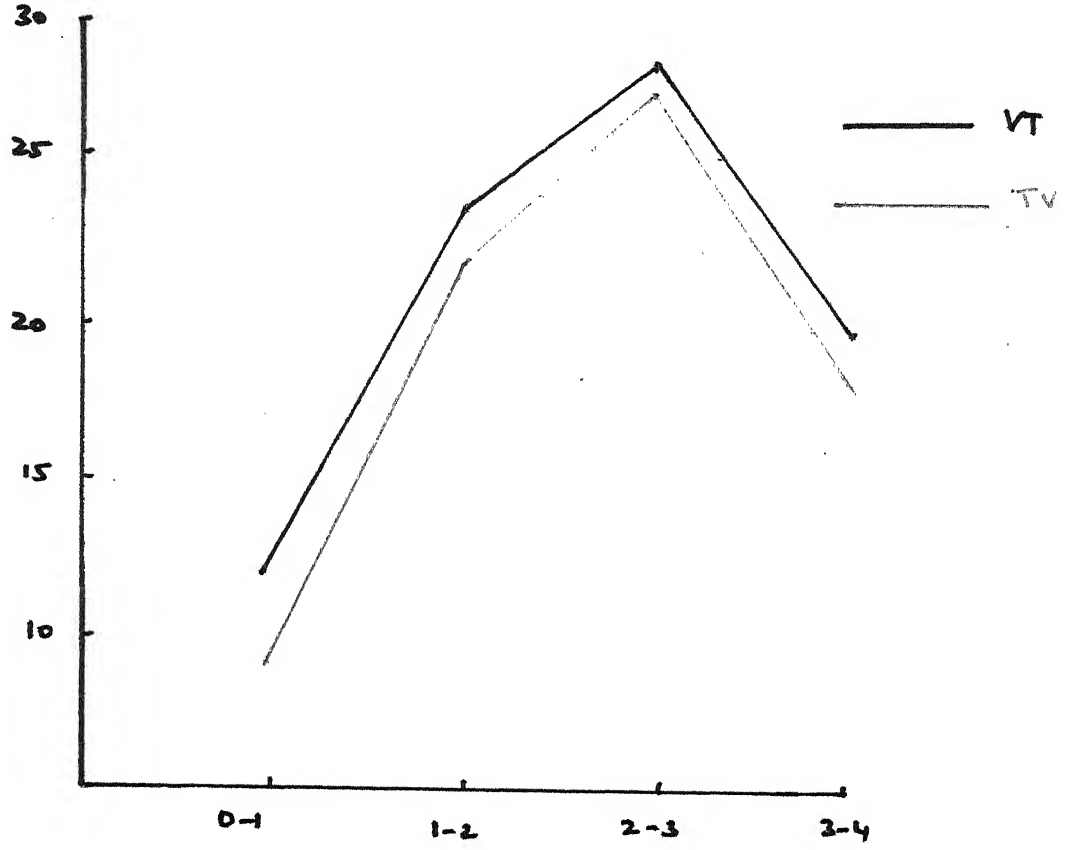
GRAPH 4:1 DISTRIBUTION OF SCORES ON SHAPE SERIES



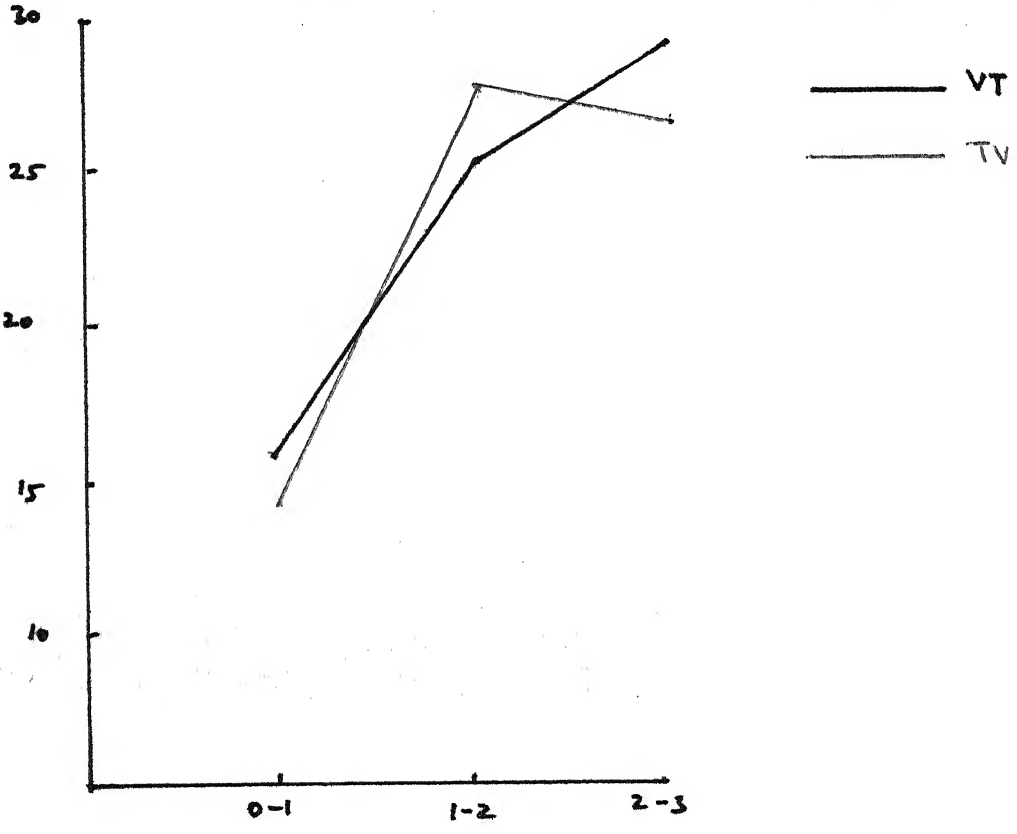
GRAPH 4:2 DISTRIBUTION OF SCORES ON SIZE SERIES.



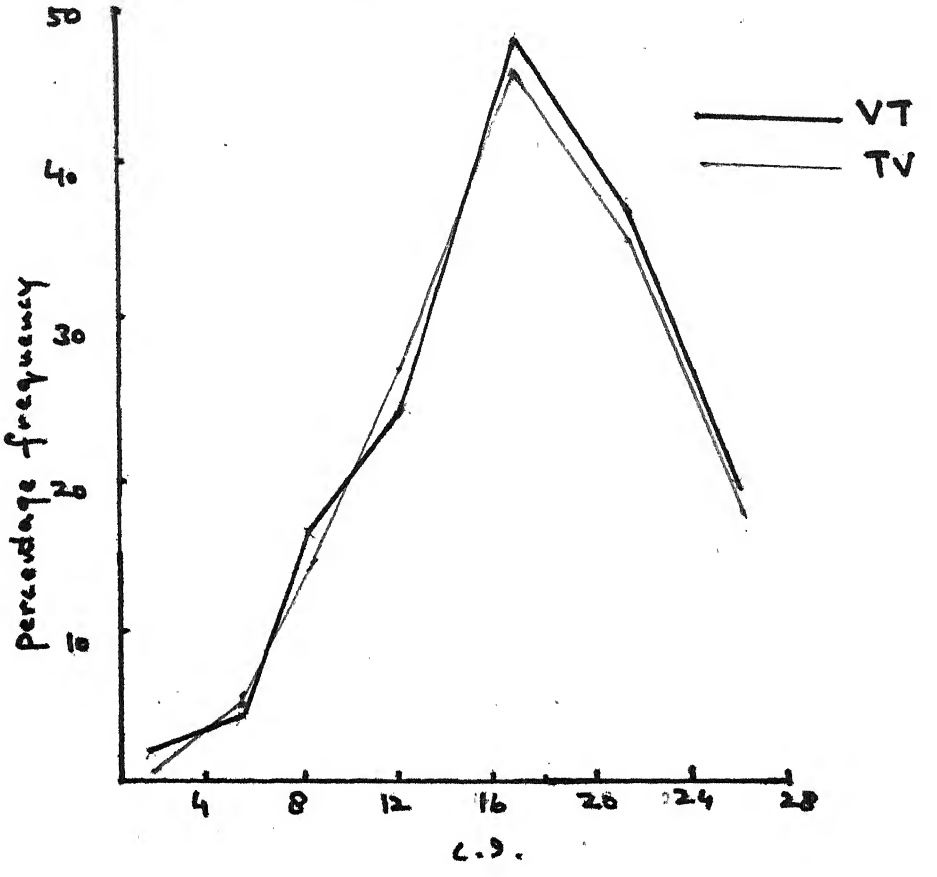
GRAPH 4:3 DISTRIBUTION OF SCORES ON TEXTURE SERIES



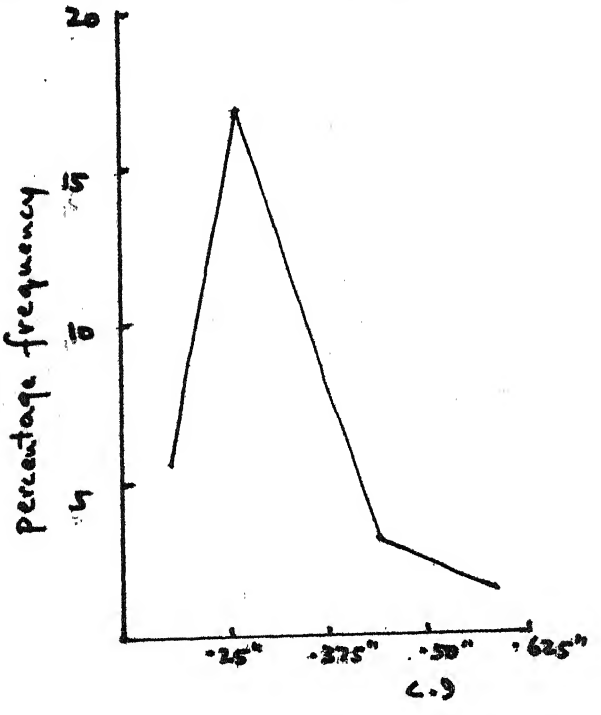
GRAPH 4:4 DISTRIBUTION OF SCORES ON HEIGHT SERIES.



GRAPH 4:5 DISTRIBUTION OF TOTAL SCORES ON INTERSENSORY TRANSFER.



GRAPH 4:6 DISTRIBUTION OF SCORES ON KFAE.



(I) Taking all the comparisons sex was not found to be a significant factor either on VT or TV series.

(II) When independent analysis was done on each series, the VT and TV differences were not found significant as none of the t values yielded significance.

(III) It was only when the data was pooled and analysed that VT and TV difference was found to be significant (table 4.5).

Section II

In this section the analysis of KFAE scores and its relationship with intersensory transfer is presented. Graph 4.6 exhibits the distribution of scores on KFAE test. The following tables give the analysis.

Table 4.6

Correlation Matrix - showing correlational values on Broad and Thin T Blocks when Right and Left Hands have been used.

	RB	RT	LB	LT
RB	-	.845	.930	.851
RT		-	.904	.940
LB			-	.939
LT				-

RB = Right Hand on Broad T-Block
RT = Right Hand on Thin T-Block
LB = Left Hand on Broad T-Block
LT = Left Hand on Thin T-Block

Table 4.6 gives the inter correlations between the 2 T-Blocks (Broad and Thin) when tested under 2 conditions, i.e., Right and Left Hand. The correlational values are all high with an average value of .35 revealing that there is high consistency and level of agreement between the Right and Left conditions, and Broad and Thin T-Blocks.

Table 4.7

Comparison of Scores on Broad and Thin T-Blocks under Right and Left Conditions.

	Condition	Mean	SD	t
a.	RB	.308"	.66"	a & b = 1.06
b.	RT	.132"	.57"	a & c = .99
c.	LB	.284"	.62	c & d = .95
d.	LT	.196"	.53	b & d = .83

RB = Right hand on Broad T-Block

RT = Right hand on Thin T-Block

LB = Left hand on Broad T-Block

LT = Left hand on Thin T-Block

Table 4.7 makes a comparison of scores under conditions of right and left hand on the broad and thin T-Blocks. The t-values are all statistically not significant, implying thereby a high consistency and uniformity between the scores.

Table 4.8

Correlational values between KFAE and Inter Modality (VT) Transfer (N = 60)

Condition	Broad T	Thin T
Right	.60	.63
Left	.67	.72

Note: All the correlation values are statistically significant (p .001)

Table 4.8 gives the correlation between KFAE and VT transfer. All the values are statistically significant revealing a positive and definite correlation between the two variables. It can be said that there is high commonality between KFAE and intersensory VT transfer.

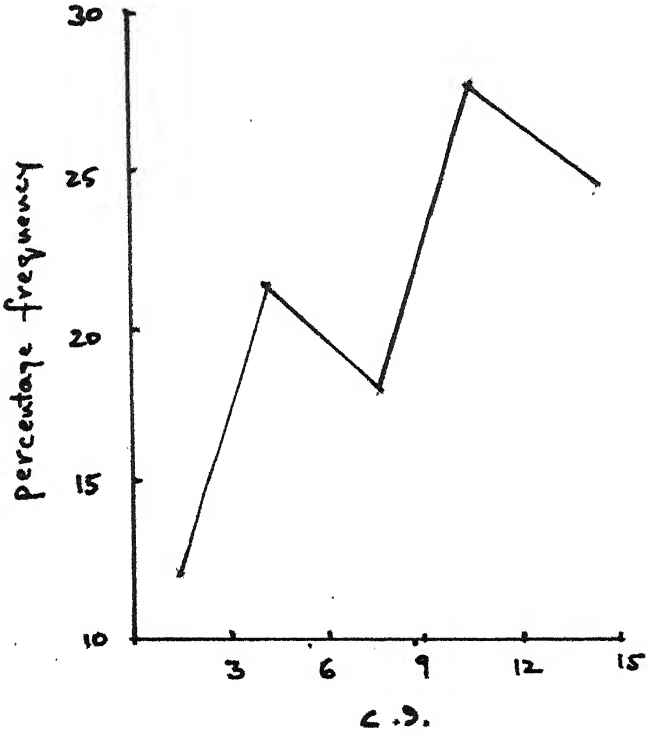
Table 4.9

Correlational values between KFAE and Inter Sensory (IV) transfer (N = 60)

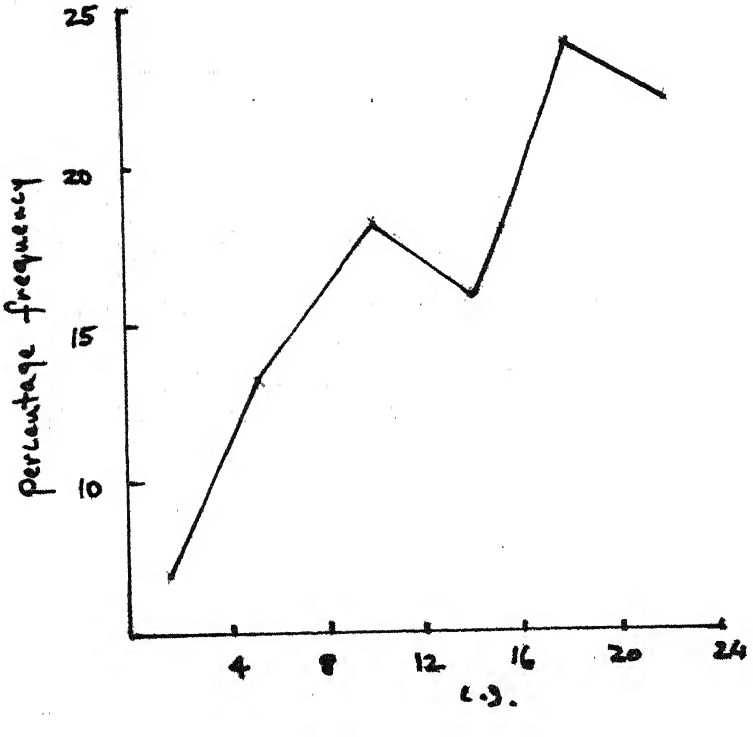
Condition	Broad T	Thin T
Right	.76	.83
Left	.35	.79

Note: All correlation values are statistically significant (p .001)

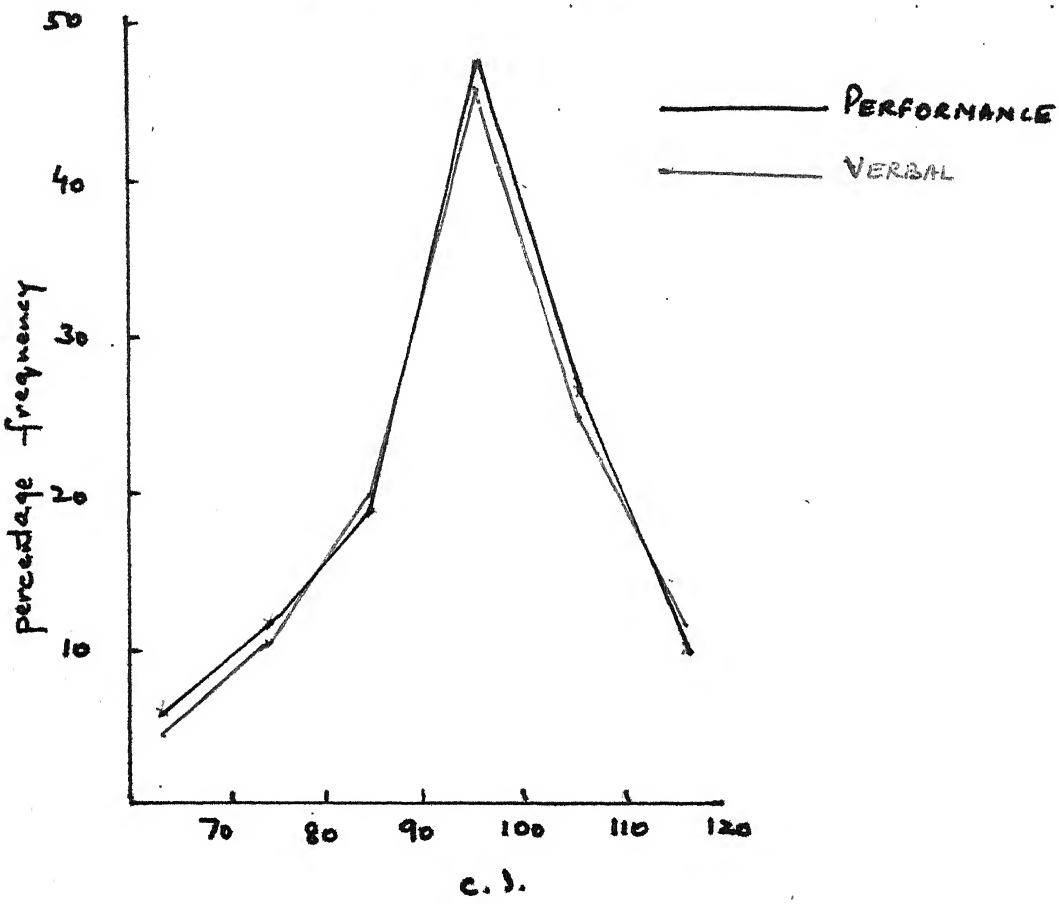
GRAPH 4:7 DISTRIBUTION OF SCORES ON 'A' SCALE



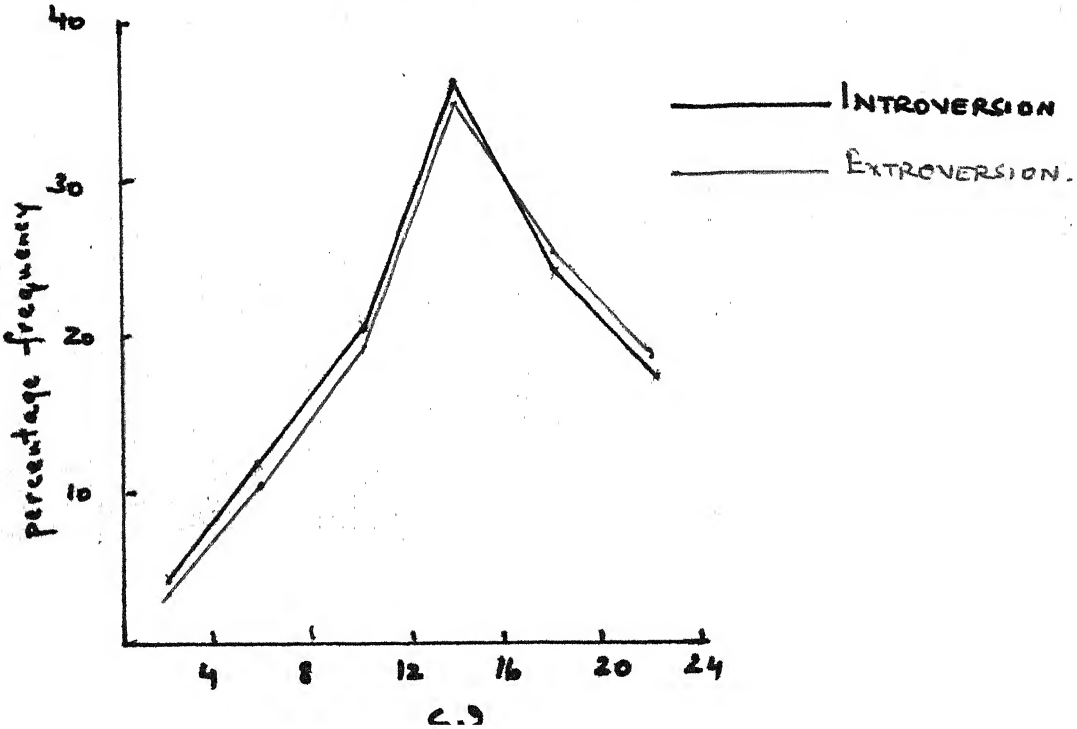
GRAPH 4:8 DISTRIBUTION OF SCORES ON 'R' SCALE.



GRAPH 4:9 DISTRIBUTION OF SCORES ON INTELLIGENCE TESTS.



GRAPH 4:10 DISTRIBUTION OF SCORES ON E.P.I.



The correlation between KFAE and TV transfer is presented in table 4.9. All values are statistically significant, implying that a high relationship between KFAE and TV transfer exists.

The main conclusions of Section II may be summarised as follows.

(I) There was a high level of consistency between the KFAE scores of Right and Left hands.

(II) There was high consistency among scores obtained on Broad and Thin T-Blocks.

(III) The correlations between KFAE and intersensory transfer were all positive, their values ranged from .60 to .86, indicating thereby that there is commonality between KFAE and intersensory transfer.

Section III

In this section are given the distribution of scores on some personality tests and the correlations between intersensory transfer and personality variables. Graphs 4.7, 4.8, 4.9, 4.10 exhibit the distribution of scores obtained on A' Scale, R' Scale, Intelligence Tests and Eysenck's Personality Inventory.

Table 4.10

Correlations between Intersensory Test and Some Personality Variables (N = 115)

Personality Variables	VT	TV	Overall
1. Intolerance of Ambiguity	.18*	.15	.17
2. Rigidity	.10	.11	.11
3. Introversion	.17	.15	.18*
4. Extroversion	.16	.15	.15

Values significant at .05 level.

From the correlational values presented in table 4.10 it can be concluded that all the correlations are so small that they are unpredictable. The values range from .10 to .18 only and are all positive.

Only two values are statistically significant, i.e., intolerance of ambiguity and VT, and introversion and overall

Table 4.11

Correlation between Intersensory Transfer and Intelligence (N = 115)

Intelligence	VT	TV	Overall
a. Jalota's Verbal Test of Intelligence	.39	.81	.89
b. Bhatia's Performance Battery.	.88	.87	.91

NOTE: All values are significant beyond .01 level

transfer. However, the values of correlation are small and only a minimal relationship between the two can be established.

The correlation values presented in table 4.11 range from .81 to .91 and are all positive, the average being .86. On both the tests of intelligence the values are significantly high indicating that a close relationship between what is measured by intelligence and the present test exists. The table also reveals that correlation between intersensory transfer and a preference test of intelligence is slightly higher (.91) than one on a verbal test (.89). Again VT transfer correlates to a higher degree (.89 and .83) than TV transfer (.81 and .87).

The analysis presented so far reveals that the only important correlate of intersensory transfer is intelligence.

Table 4.12

Mean Scores of Groups High & Low on Intelligence and Intersensory Transfer

Groups	Transfer		Intelligence	
	Mean	SD	Mean	SD
High (N=34)	20.48	12.65	100.56	25.75
Low (N=22)	7.37	4.07	73.63	15.61

To isolate this factor, and, to determine the significance or otherwise of other factors, the sample was divided into two

extreme groups based on Q_1, and Q_3 measures. In each group its corresponding mean, SD and t values were computed. Table 4.12 and the following tables describe these results.

The mean, SD of group of Intersensory transfer and performance test of intelligence are given in table 4.12. The mean difference was found to be statistically significant (t = 4.73) implying thereby that intelligence is a factor affecting transfer significantly.

Table 4.13

Mean Scores of Groups High and Low on Transfer and Rigidity.

	Transfer		Rigidity	
	Mean	SD	Mean	SD
High (N=34)	20.48	12.65	16.30	6.63
Low (N=22)	7.37	4.07	12.37	3.20

Table 4.13 reveals that the mean difference between the two extreme groups on intersensory transfer and rigidity is statistically not significant (t = 2.00). It can therefore be concluded that rigidity and transfer have no relationship.

Table 4.14

Mean Scores of Groups High and Low on Intolerance of Ambiguity and Transfer

	Transfer		Intolerance of Ambiguity	
	Mean	SD	Mean	SD
High (N=34)	20.48	12.65	10.72	2.01
Low (N=22)	7,37	4.07	8.25	0.82

The mean, SD scores on A Scale and intersensory transfer presented in Table 4.14 show that mean difference is not significant (t = 1.96). It can therefore be said that intolerance of ambiguity is not a significant correlate of intersensory transfer.

Table 4.15

Mean SD of Groups High and Low on Transfer and Extroverted

	Transfer		Extroversion	
	Mean	SD	Mean	SD
High (N=34)	20.48	12.65	9.20	2.10
Low (N=22)	7.37	4.07	13.13	4.43

Table 4.15 reveals that the mean difference between intersensory transfer and extroversion is statistically not significant (t=1.39) implying thereby that extroversion is apparently not a significant factor in intersensory transfer.

Table 4.16

Mean, SD of Groups High and Low on Transfer and Introverted.

	Transfer		Introversion	
	Mean	SD	Mean	SD
High (N=34)	20.48	12.65	9.46	1.96
Low (N=22)	7,37	4.07	14.00	3.15

The results presented in table 4.16 show that the mean difference between the two extreme groups is significant at .05 level (t = 2.01). However, the value of t obtained is relatively small and therefore unpredictable, hence, the relationship between introversion and intersensory transfer cannot be said to be definite.

Table 4.17

Mean Mean2
Mean Scores of Groups High and Low on Transfer and KFAE

	Transfer		KFAE	
	Mean	SD	Mean	SD
High (N=34)	20.48	12.65	.35	.75
Low (N=22)	7.37	4.07	.10	.37

Table 4.17 reveals that the mean difference between intersensory transfer and KFAE is statistically significant (t = 6.07). It can therefore be concluded that KFAE is an important and significant correlate of intersensory transfer.

Main Findings of the Study.

The main findings of this chapter may be summarized as follows:-

(1) Intelligence is an important and significant correlate of intersensory transfer (tables 4.11 and 4.12).

(2) Rigidity, intolerance of ambiguity and extroversion were not found to be related to transfer (table 4.10).

(3) Introversion was found to be correlated with intersensory transfer, though the correlation value is not high (table 4.10).

(4) KPAE was found to be affecting intersensory transfer significantly (table 4.8).

(5) Overall VT is superior to overall TV transfer (table 4.6).

(6) Sex was not found to be a significant factor affecting transfer (tables 4.1, 4.2, 4.3, 4.4 and 4.5).

CHAPTER VI

DISCUSSION AND CONCLUSION

CHAPTER VI

DISCUSSION

On the basis of the foregoing survey of results, certain conclusions have been drawn, and, these are discussed in the following pages. As said earlier, the purpose of the present investigation was to establish a relationship between intersensory transfer and certain personality variables. Analysis was done to test the hypotheses formulated and the discussion of the results is presented below. The personality variables undertaken for study are discussed separately, and finally a brief discussion is presented which attempts to explain the principles underlying the perception and identification of a stimulus presented visually or tactually, and the phenomenon of transfer between them.

The one variable found to have a high positive and significant relationship with intersensory transfer was intelligence. Tables 4.11 and 4.12 give the values of the correlations between these two phenomenon. These results are in consonance with Hypothesis Number 1 which thus stands proved. Obvious interpretation of this finding is that a person who is intelligent can transfer his learning, experience and perception from one sense modality to the other with greater ease and accuracy than a person who is less intelligent. An investigation carried out by Anne Ewart and Carp (1963) using simple geometric forms on blindfolded subjects found that the more intelligent had

apparently developed more distinct and complete form concepts and exhibited greater facility in relating new stimulus patterns to them. In the present investigation also simple geometric forms were the basic stimuli for measuring intersensory transfer. Perception and recognition of these stimuli may be taken as an indication of intelligence.

Intersensory transfer correlates significantly both with verbal as well as performance tests of intelligence. Correlational value with performance test was found to be higher (r = .91) than with a verbal test (r = .36). This show that there is greater commonality between intersensory transfer and intelligence based on a performance measure. To the best of our knowledge there is no study pertaining to the relationship between intelligence and intersensory transfer. The present study established this relationship. An individual with a high level of intelligence not only grasps the object presented visually or tactually but is also able to transfer this information to another sense modality which was not stimulated previously. At face value it would seem that individual differences in performance on this test would reflect differences in a persons mental capacity. A common component has been found between intersensory transfer and intelligence. It can be said that the basic ability to "break up" a configuration is manifested not only in straight forward perceptual situations, but in problem solving situations as well (Witkin 1954). There is an

indication that 'analytical ability' — an aspect of intelligence — is a factor in intersensory transfer. Witkins (1954) holds that there is a general cognitive style which runs through perceptual and intellectual functioning. He also suggests that this common cognitive style underlies the observed relations between the extent of field dependence and performance on tests of intelligence. Factor analytic studies (Cohen 1957, 1959) have identified three main factors of verbal comprehension, attention concentration and analytic factors in the intelligence tests developed by Weschler. Performance on Weschler tests is similar to the performance on EFT, i.e., separating the item from the context. Studies by Goodenough and Karp (1963) and Karp (1961) substantiate the evidence that field dependence tests measure analytical ability and EFT scores correlate highly and significantly with analytic factor IQ's. Apparently field independent perceivers may adopt either an analytical or a global attitude when the task requirements are left ambiguous. When the situation requires an analytic approach for effective performance, they are able to adopt it, field dependent people, on the other hand cannot and so, enforcedly, use a global approach. Under these conditions a relationship may be found between measures reflecting extent of field dependence and measures of analytical ability. The factors of intelligence which are revealed in the present study are verbal comprehension and

analytic factor as both k verbal and performance tests of intelligence have been used. Correlations with both are high and therefore it may be concluded that intersensory transfer represent both verbal comprehension and analytical ability and may be considered an aspect of a general cognitive style though there is not sufficient evidence for the same.

Another variable found to have significant and positive correlation with intersensory transfer was KFAE. (Tables 4.8 and 4.9). Permitting subject to draw his fingertips over the stimuli presented him with additional cues useful in perceiving and discriminating stimuli. The high positive correlations between intersensory transfer and KFAE (r = .68 to .83) show that the involved dimension which was measured was analogous. The relationship between these two phenomena may be explained by saying that both involved a common basic process, i.e., a process of transfer. Both in KFAE test as well as in inter-modality transfer test knowledge gained earlier is utilised at a later occasion. In KFAE test knowledge is gained through kinesthetic sensation and utilised later by the same modality; in intersensory transfer also, knowledge gained through vision is utilised tactually or vice versa. In this respect both tests are analogous as they employ the same basic process of transfer. However, while in KFAE the sense modality is the same, in inter-sensory transfer it is different, i.e., transfer of knowledge is from vision to tactual sense modality or vice versa. Though

the difference in sense modality from the initial occasion to the occasion of recognition is different in both tests, yet, the basic process of transfer, which is the vital one, remains the same and therefore it is reasonable to expect and obtain a high positive correlation between the two phenomena. That the KPMS test is itself reliable is shown by the high interconsistency measures ranging from .34 to .94. Kinesthetic sensations too seem to have played a contributing role in the discrimination of stimuli. The fingertips moving across the smooth surface would encounter little resistance but when moving across a harder texture a comparatively greater amount of resistance is presented. (Gibson 1966). The possibility of such a cue facilitating discrimination is suggested by the reduction in the amount of errors. It was observed, for instance, that in the case of the smoother surfaced stimuli most subjects would draw their finger across the entire length of the block before making judgment. In the case of coarser stimuli only a small portion of the figure would be totally examined before a decision was made to the identity or non identity.

Regarding the relationship between intersensory transfer and intolerance of ambiguity, the results are not conclusive. The correlations (Table 4.10) are small and insignificant. The values are, nevertheless, in the expected direction, but on the basis of such a small value ($r = .17$) no prediction

is possible. However, logically and on the basis of certain findings it has been found that lack of tolerance for ambiguous situations in 'closed minded' persons also manifests in the tendency to cling to the first impression that they happened to form of a situation, even when the situation has been objectively changed. This clinging is presumably due to the fact that the first impression which they form about the situation becomes an integral part of their mental structure which is so rigidly organised that it does not allow any possibility for them to remain sensitive to minor and gradual changes in the situation. It has been found by investigators that a person tends to cling to the "status quo", and, new ways of life, modes of conduct and ideas are not readily accepted. It had, therefore, been hypothesised that high intersensory transfer would represent low intolerance of ambiguity, but, the results of the present study do not answer this question in any conclusive manner.

A low and statistically insignificant correlation ($r = .11$) has been obtained between intersensory transfer and rigidity (Table 4.10). A negative relationship between these two variables had been hypothesised but the results are inconclusive in this regard. While the phenomenon of intolerance of ambiguity is situational, rigidity is characteristic of the person who is intolerant of ambiguity, but the results do not

throw light on the 'characteristics' of a person low and high on intersensory transfer. The degree of rigidity depends upon the particular test material employed, subjects attitude towards and interpretation of the task, and also the relationship between the subject and the tester (Luchin 1951). Failure to obtain any relationship between intersensory transfer and rigidity may be accounted for by saying that the particular "field conditions" of which rigidity is a function were not represented. Moreoever, conclusive evidence is provided by the results that no relationship exists between intersensory transfer and intolerance of ambiguity and rigidity. Both the variables of intolerance of ambiguity and rigidity have been theoretically and historically related, and, at times have been treated as approximately equivalent. The results of the present investigation confirm the contention that intolerance of ambiguity and rigidity are analogous.

A low correlation with introversion-extroversion does not prove the hypothesis that high intersensory transfer is characteristic of the introverts. The value (r = .18) (Table 4.10) is small and as such any prediction is not possible. Eysenck (1963) attempted to relate PAE with introversion and extroversion and his failure to obtain any relationship has been accounted for in terms of imbalancing of satiation and inhibition. S.K. Paul's study (1964) also tried to establish a relationship between extroversion-introversion and intersensory transfer. No

conclusive results were obtained. The results of the present study are in line with those obtained by S.K. Paul (1964), and one is likely to suspect that the method of assessing introversion-extroversion by the questionnaire method (most commonly used technique) is liable to be distorted by conscious falsification. Hence it is essential to assess the introversion-extroversion score with some more objective method where such falsification of responses is prevented. If a measure of introversion-extroversion where faking and social desirability responses is prevented is employed, then conclusive evidence may be obtained, though this does not establish such a relationship.

Another factor which was observed in testing discrimination of objects was that errors were common but with practice and training an adult was able to make an errorless run of such judgments. It was observed that as the number of trials and subtests increased, subject did not take long to identify a common pattern among all. The knowledge and familiarity of the characteristics of the test material like texture, various sizes and shapes greatly aided discrimination and affected the transfer scores. Familiarity, therefore, appeared to be a significant factor in intersensory transfer. Here it may be mentioned that in 1927 Zigler and Barrett described three stages in perception (1) initial stage in which a touch of indeterminate

shape is felt (2) intermediate stage in which some prominent feature presented suggests a tentative shape (3) the stage of definitely perceived form with greater or less clarity. Observation reveals the emergence of all these stages in the present study. Introspection bears out the contention that the phenomenal shape of the subject does emerge from such a series of transformations. The tracing out of the surface with one finger as if the observer were trying to draw a model of it or reproduce the shape, did not occur often enough to be typical. No subject ever tried to run his fingers over the whole block in a systematic manner. The normal activity may be called only 'scanning'. Tentative suggestions were confirmed, revealing the stages of identification and discrimination of objects.

Another significant finding was the superiority of VT (visual to tactual) transfer to TV (tactual to visual) transfer. The relative superiority of VT transfer may be accounted for by saying that the initial information provided in the VT transfer condition was of a wider nature. When observing a block, the subject was able to comprehend not only its shape, size, height, colour, width but also the textural qualities of the stimulus which formed the basis of tactual sensation later on. Under the TV condition, however, the initial information was comparatively meagre. Instead of the whole object being present only a characteristic of the stimulus was available to

the subject which formed the basis of identification. It is therefore reasonable to obtain a superiority in performance on VT conditions than TV. Considering it from the evolutionary point of view also it is known that the earliest receptor was tactual sensation. In the process of evolution more receptors were evolved and vision was the last to occur. Vision is the most developed and a wider sence, it is known as the 'distance receptor' and spoken of as an 'extension of the brain'. The relative superiority of the functions with which the sense of vision is endowed explains the superiority of VT transfer.

That it is possible for subjects to discriminate without visual cues between various surface textures has been demonstrated (Major 1898, Ziglerand Barret 1927, Zigler and Northrup 1926). Whether or not this ability may be used in practical applications will depend, at least in part, upon the demands of the situation in which it is to be used. The question of the practicability of texture coding of industrial or military equipment must be determined through further research. One implication of the study seemed to be, that tactual cues arising out of stimulus variables like location, shape, colour, size, mode of actuation etc. contribute to the more rapid learning and more efficient operation of controls and may be utilised in the coding of equipments and instruments.

The question now arises how does a perceiver feel what he is touching instead of the cutaneous impression and the bone postures as such. The animal registers the shape of the chair in which he sits. The primate feels the branch he grasps and the protoman must have felt the roundness of the stone he threw, the wedge shape of the hand axe, or the lit of the pot, even without looking at it. The sailor can feel the rope and tie the know even in darkness. The violinist can feel the stages and spaces of his instrument with extraordinary precision while keeping his eyes closed. The man with a walking stickcan even feel stones, mud, or grass at the end of his stick. Yet all these perceptions come from the contacts between the adjacent surfaces and the skin and the contacts of bones upon one another.

If a blindfolded human observer is encouraged to report the nature of an object applied to his skin instead of the sensory impression, he finds the task quite natural. His reports are generally correct. For example, if the skin of his forearm is stroked by the experimenter in a standard manner with one of four instruments having (1) a rounded wedge that 'rubs' the skin, (2) a sharp wedge that 'scrapes' the skin, (3) a small cylinder that 'rolls' the skin, and (4) a tuft of hair that 'brushes' the skin, he distinguishes among them without error. One might guess that the same feature of rubbing, scraping and brushing occur in the acoustic sequence when these events emit sound from a distance.

Some evidence also exists that the space between the opposable thumbs and the index finger (or any other finger) is clearly experienced. This use of the hand is like that of the mandible in an insect (Kelvin 1964). The width of the two blocks can be compared successively in this way and small differences can be detected or the width and height of the same object can be compared by successive spanning with two fingers. In fact, the relative dimensions of an object can be simultaneously perceived by the relative spans between all five figures. When all five fingers touch an object there are five distinct sensations of touch but there is perception of only one object. Multiple touching of this sort yields haptic perception in the literal meaning of 'laying hold of'. If two invisible blocks are spanned between the opposed fingers of the two hands at the same time the widths can be readily compared and available width can be marked to a standard. Kohler and Dinnerstein (1949) used this perception in theoretical studies and called this experience 'kinesthesis'.

Active exploratory touch permits both the grasping of an object and a grasp of its meaning. The hand can grope, palpate, prod, press, rub or heft and many of the properties of an object can thus be detected in the absence of vision. The properties we call 'tangibles' are (1) geometrical variables like shape, dimensions and proportions, slopes and edges, and

curves or protruberances, (2) surface variables like texture, or, roughness-smoothness, (3) material variables like heaviness or mass and rigidity-plasticity. The material colour (pigmentation) of a surface is not tangible but only visible. The relative temperature, however, is tangible not visible. Haptics is not so inferior to optics as we suppose since the blind depend upon it for a whole realm of useful perception (Revesz 1950).

One is accustomed to think of the hand as a sense organ since most of our day to day manipulation is performatory, not exploratory, i.e., we grasp, push, pull, lift, carry, insert or assemble for practical purposes, and the manipulation is usually guided by visual as well as by the hpptic feedback. The perceptual capacity of the hand goes unrecognised because we usually attend to its motor capacity, and also because the visual input dominates the haptic in awareness. But the skin sensitivity is essential. It always accompanies and underlies visual sensitivity. When the eyes are open and the observer is looking it makes an even more fundamental contribution to the control of motor skill than vision. One becomes aware of haptic perception as such only when he must work in dark, or without looking, or when occasionally it is actually more acute than visual perception. Examples of the latter would be when the butcher tests the sharpness of a knife with his finger over it.

Shape: A method of investigating the perception of unfamiliar shapes by active touch was illustrated by Gibson (1962, 1963). Ten different sculptural objects were designed for the purpose being felt with the hands. The shapes designed were composed of convex, concave, and saddle-shaped surfaces on the front side, and a regular convex backside. All had six protuberances. They could conveniently be held in one hand and fingered with the other. When an observer is given one of these shapes to feel with his hands behind the curtain he typically does the following things:-

(i) He curves his fingers around its face, using all fingers and fitting them into the cavities.

(ii) He moves his fingers in a way that can only be called exploratory. Since the movements do not seem to become stereotyped, or occur in any fixed sequence, or even to be clearly repeated.

(iii) He uses oppositions of thumb and fingers. He rubs with one or more fingers and occasionally he seems to trace a curvature with a single finger. The activity seems to be aimed principally at obtaining a set of touch postures, the movement as such being incidental to his aim.

The theory of the essential role of finger direction

and finger spans, the 'bone space' seems to be confirmed by the present results. In tactual exploration, the pattern that the various cutaneous pressures make to one another cannot be detected but only the pattern which the parts of the object make toone another. The skin form changes from moment to moment as the hands move. The unity of perception cannot come from the skin alone. It must come from the bones and the skin together in terms of the spatial invariants that relate them. This is not the traditional theory that skin sensations are the elements from which a perception of the object is constructed by past experience with kinesthesis. Instead it would seem that the skin sensation, if they can be detected at all, are symptoms of cutaneous stimulation, incidental to the activity of the haptic system.

Surface Texture: David Katz (1925) obtained a dozen kinds of papers differing chiefly in the variable of rough and smooth, with blotting paper at one extreme and writing paper at the other. His observers, without vision, could distinguish among all of them "by touch". But they could not do so by mere contact or pressure, it was necessary to rub a finger over the surface, if only slightly to obtain a perception of the texture of the surface. Presumably there had to be a mechanical friction with resulting lateral vibration of the skin. The stimulus information had to be obtained.

Several investigators have found that commercial grades of sand paper can be distinguished in his way by untrained subjects (Stevens and Harris 1962). Still another variable is slipperiness. The analysis of the variables of surface texture are specified in the stimulation available by looking, i.e., in the optical texture projected from the surface. The texture of a surface is probably even more important to animals than its pigment colour in identifying it, but the discrimination of texture has scarcely been studied by sensory psychologists, whereas the discrimination of colour has enlisted a disproportionate amount of research.

The capacity of touch to register information can be illustrated by another experiment. Binns (1937) studied the ability of wool grades to judge the softness of an untwisted rope of fibers from a fleece a sample called 'wool top'. This quality seems to correspond to the physical variable of the fineness of the fibers and determines the value of a fleece to the wool industry. The normal procedure was to pull a strand through one hand and look at it carefully, assigning a grade. Binn's required his subjects to feel the wool tops without being able to see them and to look at them on a black background without being able to feel them. The tactual judgments of softness were in 'remarkably good agreement with the visual judgments'. Furthermore, he found that nonprofessional, unpractical observers using this method of active feeling without looking

could give spontaneous judgment of softness as well as the professionals.

As a first approximation to such an description we might say that the individuals differ in the degree to which psychological processes are subject to alteration by the pressure of other psychological processes which are adjacent in space. A suggestion for further research may be an approach to classical learning situations in terms of individual differences in ability to structure experiences may prove fruitful. While conducting the intermodality transfer test it was observed that some subjects exhibited lack of self confidence, others appeared anxious and tense, seemed to feel helpless and overwhelmed by the test, and in general found the task trying and unpleasant, in other words there were individual differences in the reactions to the task itself. The study of the status of a persons defensive structure and the extent to which a high level of differentiation involves a developed control structure would be interesting. With a less structured defensive system a greater amount of anxiety is apt to be expressed, so that extent of open anxiety may reflect indirectly on nature of defensive structure. These defensive structure patterns may be revealed by investigating the child rearing practice and the nature and degree of socialisation. It would also be beneficial if instead of discrete

aspects like introversion-extroversion, rigidity etc. an extension is made to relate intersensory transfer with personality as such in the clinical field.

The results of the study seem to warrant the following conclusions:-

(1) Intelligence was an important factor in intermodal transfer.

(2) KPAE and intersensory transfer scores represented a high level of commonality.

(3) No sex difference in capacity for intermodal transfer was observed.

(4) VT transfer was found to be significantly superior to TV transfer.

(5) A great deal of learning took place during a short period as shown by a marked increase in accuracy.

(6) Intersensory transfer was not found to have any correlation with introversion-extroversion, rigidity and intolerance of ambiguity.

SUMMARY

INTER MODALITY TRANSFER AND ITS PERSONALITY CORRELATES

This study was undertaken to investigate the phenomenon of intersensory transfer between the sense modalities of touch and vision and correlates the variables of intelligence, rigidity, intolerance of ambiguity, extroversion-introversion and kinaesthetic figural after effect. By research in sensory interaction is meant generally investigations that explore modifications of response in one sense organ under direct stimulation when another sense organ has been or is subject to stimulation. That interaction does exist between the senses is confirmed by a number of observations, for example, a sound like the scraping of a knife on glass evokes a sensation of 'creeps', excessively hot food causes a sensation of high temperature and the like. The relationship between intersensory transfer and personality was assumed to be a holistic one. It was assumed that 'perception is a reflection of the relation between proximal stimulation and ongoing organismic states'. Proximal stimulation refers to the stimulation of sensory surfaces which issues from a physical object and organismic state represents the total ongoing state of the organism. An analysis of the individual differences was assumed to reflect and represent a 'self' or 'style' in the different modes of orientation and different degrees of intersensory transfer.

It was hypothesized that intersensory transfer would be positively related with intelligence and FAE, negatively with

rigidity and intolerance of ambiguity and high intersensory transfer would represent characteristics of an introvert. A secondary hypothesis was that visual to tactual transfer (VT) would be superior to tactual to visual transfer (VT).

To study the phenomenon of intersensory transfer a test was developed. The test 'Inter Modality Transfer Test' was constructed in wood and comprised of four series - shape, size, height and texture. In each series there were five subtests and each subtest comprised of three wooden geometrical shapes. To measure the intersensory transfer each subtest was presented first to the visual sense (test) and later to the tactual for identification (recognition). A correct identification revealed a visual to tactual (VT) transfer. Similarly, each subtest was presented to the tactual sense (test) and later to the visual for for identification (recognition). Correct identification revealed a tactual to visual (TV) transfer. There were a total of twenty subtests (5 subtests x 4 series = 20). Pilot study was done on a sample of 26 undergraduates. Reliability was computed by test-retest and split half method. The values by split half method were $r = .72$ and $r = .70$ for VT and TV series respectively. After item analysis only fourteen subtests were selected for final study. The final test comprised of four subtests of shape series, four of size series, two of height and four of texture series.

The other personality tests were Kool's A Scale, Kool's R Scale, Eysenck's Personality Inventory, Jalota's Verbal Intelligence Test, Bhatia's Performance Battery of Intelligence Test and KPAE Test. Data was collected on a sample of 116 undergraduates - 53 females and 57 males.

Analysis of the results revealed that intelligence was positively correlated with intersensory transfer, $r = .91$ with performance, and $r = .86$ with verbal; KPAE was also found to be positively related with intersensory transfer, average value of correlation being $r = .56$; sex was not found to be a factor in facilitating intersensory transfer; VT was superior to TV; and no relationship was revealed between intersensory transfer and the variables of intolerance of ambiguity, rigidity and introversion-extroversion.

The high correlation between intelligence and intersensory transfer was explained on the basis of analytical ability; KPAE and intersensory transfer involved a common basic process of transfer. No conclusive evidence was obtained regarding the particular 'style' of a person low or high on intersensory transfer.

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A P P E N D I C E S